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MR. HENRY R. TOWNE, the President of the Yale and Towne Manufacturing Company, writes to the *Sanitary Engineer*, mentioning the advantage which he has found in the use of free steam in moistening the air of his house in winter. It is needless to say that the observations of a man like Mr. Towne would always be interesting, and in this case they have a considerable practical importance. The house in question is heated by steam, on the indirect plan, fresh air from the outside being brought in contact with box coils in the cellar, and thence delivered through pipes and registers into the rooms. Although the usual evaporating-pans and other appliances for communicating moisture to the dry external air were provided, Mr. Towne found that, as shown by the hygrometer, its condition, when delivered in the rooms, was far below the standard of moisture which is recognized as most conducive to health, the percentage of humidity ranging from thirty to forty per cent of saturation, while sixty per cent is considered to be the most wholesome proportion. With the idea of increasing the humidity, Mr. Towne then resorted to extra evaporating-pans, porous cups in front of the registers, and even wet cloths hanging from pans of water, and, by their action, partly of capillarity, and partly of siphonage, extending greatly the area of wet evaporating-surface. All these devices combined, however, as he says, failed to increase the moisture more than from five to ten per cent. Finding these devices inefficient, as well as troublesome, he then had one of the steam coils tapped, so as to admit a small jet of steam directly into the air-box. This at once raised the proportion of moisture so greatly as to convince him that nothing more would be necessary to communicate any desired amount of humidity to the air, and he had two coils arranged with small openings, controlled by valves, for admitting steam, to mix with the warm-air supply to the rooms above. With these it is found perfectly easy to maintain the proportion of moisture at fifty or sixty per cent of saturation during the winter, and the proportion can readily be increased by opening the valves wider, but it is found that a moister atmosphere gives trouble by excessive condensation on the windows.

THIS method of improving the quality of the warm air supplied to rooms is not altogether new. The Walworth Manufacturing Company, of Boston, if we are not mistaken, has long made and sold a valve, with a little condensing-kettle and drip-pipe, for allowing steam to escape in small quantities from coils or radiators, either in direct or indirect heating, for the express purpose of moistening the air which circulates about the radiator, and we think it very probable that similar ones may be obtained of other manufacturers. However they may be arranged, their efficiency is surprising. Not long ago, we were in a house which has a small conservatory opening out of the hall. The floor of the conservatory is about ten feet above the street, and, as it faces the south, and is surrounded on three sides by furnace-heated rooms, and is itself warmed by direct radiation from two small vertical-pipe radiators, standing in it, the air in it would under ordinary circumstances be very dry, far too much so for the health of plants, unless constant syringing were resorted to. In order, however, to counteract the dryness naturally resulting from the conditions, a Walworth valve had been attached to one of the radiators in the conservatory, and kept a thread of vapor always issuing into the air. Nothing could be simpler than this, but its efficacy may be judged by the fact that on the morning when we observed it, although the thermometer inside the conservatory stood at eighty degrees, and that in the adjoining rooms at seventy-five, the thick plate-glass windows between were covered with a copious condensation. It is hardly necessary to say that an atmosphere at eighty degrees, showing a dew-point of seventy-five degrees, contains nearly the utmost amount of humidity which it can receive. All plants would not thrive in so moist an atmosphere, but it suited most of the tropical ones which were in the conservatory, and was at least more generally congenial than the parched air of most conservatories attached to dwelling-houses. How far a similar air would be beneficial to human beings is a disputed point. Most people breathe more freely, and with a certain sense of refreshment, in a very moist air, but in our winters there is perhaps an increased danger of taking cold in going from a moist atmosphere to the keen, dry air out of doors, and we have known it earnestly argued that on this account, in cold weather the air of dwelling-houses should not be allowed to get too moist. We leave the settlement of this point to the sanitarians, nearly all of whom, however, take the opposite view, and will content ourselves by remarking that, as Mr. Towne says, an atmosphere containing sixty per cent of humidity feels as warm as a dry air at a temperature at least five degrees higher. Mr. Towne says that a moist air at seventy degrees is more comfortable than a dry one at eighty. We should not consider either of them comfortable, but would rather say that an air with sixty per cent of moisture at sixty-five degrees of temperature feels as warm as the ordinary air of a furnace-heated house at seventy or seventy-two degrees, and is much pleasanter, and, according to our own experience, more wholesome. It may be well to make the observation that if valves for admitting steam directly to the atmosphere are placed on coils or radiators, the boiler should be well cleaned, and care be taken to supply it with ample quantities of pure water. It should not be forgotten that the jet of free steam is practically a small jet of water from the boiler, which must be often replaced, or the tubes will burn out, and perhaps even explosions ensue; and if the water-supply is impure, or the boiler lined with deposit, the steam will carry with it into the air of the rooms a smell of stewing organic remains, which is anything but agreeable.

WE wish to call attention to the examination of candidates for the Rotch Travelling Scholarship in Architecture, which takes place at the Museum of Fine Arts in Boston, on Thursday morning, April 7, at nine o'clock. As usual, the first examination will be a preliminary one, and candidates will only be required to make on the spot and submit a sketch design, upon a programme to be assigned at the time. The sketch designs will be considered, and the authors of those which appear to the examiners satisfactory will be notified to appear on the eleventh of April, and the two following days, for examination in the history of architecture, in free-hand drawing, construction, perspective, shades and shadows, and French. On the seventh of May the finished drawings of the design indicated by the sketch made a month before must be handed in, accompanied with an accurate perspective; and this will complete the examinations. Certain changes have been made in the arrangement of the examinations since last year. Those relating to construction, history and other topics, instead of being postponed to the end of the month following the preliminary trial, take place four days afterward, so that the candidate may have them off his mind, and be free to develop his design without being distracted by the necessity for keeping up his French or his graphical statics. Another change which concerns the examiners primarily, and the candidates indirectly, is that the history of architecture is to count for twenty points, out of a total of seventy-five for all subjects except design, instead of fifteen points, as heretofore; and French, instead of fifteen points, will now count for only ten. Experience has

shown all these changes to be desirable, and the new arrangement will probably be permanent.

OF the value of the Rotch Scholarship to the profession, and, we might say, to the country, as well as to the candidates, we can only repeat, with more confidence than ever, our high opinion. Since its establishment, the draughtsmen and young architects of Massachusetts have had something to work for worthy of their ambition, and they have not failed to avail themselves of the opportunity. In such an effort all gain, the unsuccessful candidates nearly as much as the successful ones, and the standard of attainment among the younger members of the profession is continually advancing. We can hardly say whether more credit is due to the wisdom of the examiners in selection, or to the excellence of the material offered, but it is certain that the Rotch scholars so far have gained distinction abroad for the profession in America, as well as for themselves. Our readers already know something of the interest which Mr. Blackall's earnestness and ability excited among foreign architects, and the kindness which was everywhere shown him by the profession; and his successor, Mr. Mead, has already gained laurels of a different kind for himself and his brethren. The beautiful sketches in black and white, from his hand, which we have had the pleasure of reproducing so often during the past year, have shown sufficiently his artistic feeling and power of drawing, and he has recently turned his attention to work in color, with extraordinary success. Such of his color sketches as have come to this country have called forth the warmest praises from those who have seen them; and a little exhibition of similar works which he gave recently in London aroused even the *Saturday Review* to words of admiration such as it seldom condescends to bestow upon anything American. Two or three years ago, on the occasion of the publication in Boston of the Architectural Association Sketch-Book, the London professional journals warned their readers that the young American architects had nothing to learn from their transatlantic cousins in the matter of architectural sketching, and that if the latter did not bestir themselves they might find the Americans far in advance of them. So long as Alfred Waterhouse and Ernest George, and a few others, continue to hold brush and pen, we hardly expect to see the champions of England beaten by the best Americans, but there is no one among the younger Englishmen who seems particularly destined to wear Waterhouse's or Norman Shaw's mantle, while the Americans seem, so far as we can judge by the exhibitions, to gain year by year, and out of half a dozen of the more prominent ones, it would be hard to say which is first.

PUBLIC opinion, to judge from the newspapers, is rapidly accumulating against the tyrannical practices imported from the Old World by the leaders of labor organizations, and used so recklessly to maintain their power over the poor and helpless. To relate the instances of almost savage cruelty and treachery on the part of the trades-union leaders would be an endless task, but the accounts begin now to be diversified with an occasional example of the punishment of the Union conspirators against other people's living. A few weeks ago a builder in New York happened to transgress one of the Union rules, by employing some person, or using some materials or apparatus under the Union interdict. A walking delegate thereupon presented himself, and began to talk to the workmen, as a preliminary to calling upon them to pack up their tools and leave the building, when the contractor saw him, and, suspecting what he was about, ordered him off the premises. The walking delegate, nearly stupefied at this insult to his despotic authority over masters and men alike, refused to obey, and the contractor immediately sent for a policeman, who, on his complaint, marched the delegate to the station-house, where he was arraigned and fined ten dollars for illegally interfering with some one else's business. In a subsequent instance another walking delegate, who had begun his exhortations to the workmen employed by a contractor whom the Unions wished to injure, was arrested in the same way, at the contractor's request, and fined fifty dollars by a judge somewhat less amiable than the other. In a third case, an architect was so ill-advised as to take the law into his own hands, and, finding a walking delegate pouring his siren strains into the ears of the men in a building under his charge, immediately proceeded to express his opinion of such conduct by kicking the delegate downstairs and out of the building. The injured magnate consoled himself by procuring a warrant for the architect's arrest on a charge of assault and battery, but the matter was compromised by an apology from the architect, which was good-naturedly accepted by his victim.

EVERY one has heard something of the remarkable substance extracted from coal-tar, which is three hundred times as sweet as sugar, and most persons have probably looked forward with apprehension to the time when this interesting product should be surreptitiously substituted for natural sweetening in the food offered them to eat, with results which they did not care to investigate. It would seem that this time is not very far off, to judge from an article in the German *Sugar Manufacturer's Journal*, which says that an establishment for the production of the artificial saccharine is nearly ready for business in Westerhusen, near Magdeburg. The material produced in the factory is to be used, it is said, for mixing with glucose. One part of the new saccharine, mixed with five hundred parts of glucose, gives a compound as sweet as the beet sugar universally used on the Continent, and at a much smaller price, since glucose can easily be made out of rags, refuse potatoes, or a score of other inexpensive substances, while the other ingredient of the imitated sugar is produced with little difficulty from another cheap material. Naturally enough the persons who have invested their money in beet farms, and costly establishments for extracting pure sugar from the roots, do not like the idea of finding their goods driven out of the market by so shabby a competitor as the starch and tar sugar, but the German manufacturers do not seem to have found any way of defending themselves. The committee appointed to consider the matter did, indeed, resolve to petition the Government to lay a tax on the saccharine, but as the substance can be readily made on a small scale, it is hardly to be expected that the tax can be collected; still less that the manufacture can be stopped. The controversy seems likely to resemble in many points that which has so long raged in this country in regard to oleo-margarine. There appears to be no evidence, in the case of either substance, that it is injurious to health; yet most people prefer to know what they are eating, and it would not, perhaps, be amiss to compel the labelling of packages of glucose sugar, in the way that packages of oleo-margarine are labelled with us.

THE *Deutsche Bauzeitung* describes and illustrates a pretty chandelier for incandescent lights, which has just been placed in the new Stadt Theatre in Halle, and differs completely from the ordinary electric-light chandeliers. Most of these, as every one knows, are modelled after the fashion of gas-fixtures, having, however, the gas globes replaced by objects somewhat resembling the corolla of a gigantic lily, turned downward, and containing the incandescent light-bulb as a sort of pistil. The effect of these is even more stringy and naked than that of a gas-fixture, and it would be hard to change the model without improving it. In the Halle Theatre, the modification is made by forming the body of the chandelier like one of the "sun-burners" so much used in public halls before the introduction of electric-lights, but of a rather ornamental shape, resembling a large vase of prismatic and opalescent glass, attached to the ceiling by its upper rim. The outside of the vase is supported by an enriched framework of bronze, the upper portion of which forms an open net-work for ventilation, and festoons of fruit and flowers, in hammered and chiselled bronze, hang from various portions, alternating with grotesque heads. The interior of the chandelier is well furnished with lamps, which shine through the cut and colored glass, and other lamps, either in the shape of plain bulbs or with a setting of reflecting substances, take the place of fruits in the festoons and garlands, and encircle, like crowns, the grotesque heads. It can easily be imagined that a charming effect can be obtained in this way, and the suggestion is susceptible of infinite variations. We remember seeing at a great flower show in the Metropolitan Opera-House, a fountain surrounded by a sort of hedge of lilies in blossom. Among the flowers were scattered hundreds of tiny incandescent lamps, which received from them at least as much attraction as they gave in return by means of their light, and we imagine that a good many people thought, like ourselves, that the possibilities of the sparkling lamps, as a decoration, might be studied with great advantage by those trained to such work.

EARLY SETTLER MEMORIALS.—VIII.

MEMORIALS TO MAJOR-GENERAL ANTHONY WAYNE.

Monument to Gen. Anthony Wayne, Radnor, Pa.

MAJOR-GENERAL ANTHONY WAYNE, having faithfully performed his duties as sole commissioner of the Government for treating with the Northwestern Indians, and as receiver of the military posts given up by the British, was on his way across the lake, from Detroit to Fort Presque Isle, now Erie, Pa., in November, 1796, when he was attacked with the gout, and died December 15, in the Block House of the latter place. According to his wish, he was buried at the foot of the flagstaff, on a high bluff, called Garrison Hill, north of the present Soldiers' Home. His coffin bore his name in gilded brass nails, and was covered with a cloth, and placed in a brick vault made in the clay ground.

In 1809, Colonel Isaac Wayne, his son, came to Presque Isle in a two-wheeled vehicle, to get his father's remains. In company with an old army surgeon, a friend of his father, and some citizens of the town, he started out in search of the grave. For a long time the search was in vain, and only by the chance meeting of a little boy who was tending cattle on the hill, and who pointed out the place, were they able to find it. He found the body in a state of almost perfect preservation, and the clothes and boots were quite undecayed. The latter articles were given to an old soldier, who wore them a long time, in honor of his old general. It being impossible to carry the body intact to its place of destination in the above-mentioned vehicle, it was decided to remove the flesh from the bones, which was done by boiling. The flesh was reburied in its former receptacle, and the bones taken to the graveyard of St. David's Church, Radnor, Newtown Township, Pa. In another part of the church-yard is the grave of Mary, the wife of the General, who died three years before her husband. Near this place Wayne spent his boyhood's days. The quaint appearance of this old ivy-clad church, built before 1716, is an object of admiration to all who visit it.

Sixteen of the brave fellows who fell in the massacre at Paoli, on the night of September 20, 1777, when Colonel Anthony Wayne and his men were surprised and attacked, are said to be buried in the little hollow west of the gallery stairs.

Rev. George Currie, a learned Scotch divine, held the incumbency for almost half a century, beginning to preach in 1736, and resigning, owing to political motives, in May, 1776. This he did through respect to King George, the head of the Church of England at the time. He again resumed charge in 1783, and energetically labored to repair the damages caused by the Revolutionary War. During that stormy period, religious services were seldom held in old St. David's. All the available lead that could be found about the building, even to that which fastened in the panes of glass in the windows, was utilized.

General Wayne's chaplain was a Baptist preacher, Rev. David Jones. He was a staunch, out-and-out patriot, serving faithfully from 1777 to 1783. As a general rule the Baptists were all patriots.

A historian of the church says of the pastor: "Old Davy Jones climbed into the lofty pulpit, and having glanced around, in order to assure himself of the attention of his audience, was completely disconcerted. He saw seated comfortably before him several young and active men, who had been hidden from view by the old-fashioned, high-back pews. In an instant patriotism had so completely mastered him that he threw away his sermon, and, shaking his fingers vehemently at the astonished youths, demanded to know why they did not go into the American army and fight the British. 'I'm not afraid to go,' he screamed; 'they can't hurt me. They may kill me, if they like, and make a drum-head of my old hide, but they will play a hummy-drum, drum, hummy-drum, drum, till the British are scared out of the country.' Then, in wild excitement, he threw off a heavy cloak which hung around his shoulders and displayed an American uniform."

At the time of his death General Wayne was Commander-in-Chief of the United States Army, and but fifty-two years old.

In 1809 the Pennsylvania Society of the Cincinnati erected a marble monument over the remains in the churchyard, eight feet high, at an expense of five hundred dollars. It was dedicated with imposing civic and military ceremonies. It bears the following inscriptions on the north side:—

In honor of the distinguished
Military services of
Major-General Anthony Wayne,
And as an affectionate tribute
of respect to his memory,
this stone was erected by his
Companions in arms,
The Pennsylvania Society of the Cincinnati,
July 4, A. D., 1809,
Thirty-fourth Anniversary of
The Independence of
The United States of America;
An event which constitutes
The most
Appropriate eulogium of an American
Soldier and Patriot.

On the north side:—

Major-General
Anthony Wayne,
Was born at Waynesborough,
In Chester County,
State of Pennsylvania,
A. D., 1745.
After a life of honor and usefulness,
He died, in December, 1796,
At a military Post,
On the Shores of Lake Erie,
Commander-in-Chief of the Army of
the United States,
His military achievements
Are Consecrated
In the history of his Country,
and in
The hearts of his Countrymen.
His Remains
are here deposited.

The old block-house was destroyed by fire about thirty years ago, the parade ground graded off for a fair ground, and every trace of the old hero's grave was lost.

In 1872, during the small-pox epidemic, the city of Erie erected a pest-house or hospital on Garrison Hill. While digging the cellar of the building, some Indian relics and old military buttons were found and preserved by the physician in charge of the hospital. In 1876, this physician, in going to and from his duties, rode a lively horse, and, as he galloped over the green sod of the hill, his attention was attracted repeatedly, at a certain place, by a hollow, rumbling sound. Directing one of his assistants to examine the spot, they discovered the lost grave of Wayne, on January 7, 1876. On opening the coffin, it was found to contain pieces of dark material, like dried flesh, and four old English knives, with hooked ends. The lid of the coffin was marked, as before described. Near the grave was also found the foot-piece of the old flag-staff, made of two large chestnut logs in the form of a cross. The news of the discovery spread with great rapidity, and caused throughout the State a feeling of deep satisfaction. On the coming Decoration Day a squad of veterans visited the grave. In 1879 the State appropriated one thousand dollars, and soon after five hundred dollars more, for the purpose of erecting a monument on the spot. The committee who had charge of the execution of the monument were Capt. J. H. Welch, Mayor D. T. Jones, and Dr. E. W. Germer.

Block-House at Fort Presque Isle.

They placed a new stone over the grave, and built over it, as a monument to "Mad Anthony's" memory, an exact copy of the old block-house, which Wayne himself had first built in 1791. The present one is made of squared oak logs, well notched together at the corners. The first story is sixteen feet square and ten feet high, with a door in one side. The upper is octagonal in shape, and made to project several feet over the lower, thus making it difficult of access, except through the interior of the lower room. A flight of winding steps permits of ascent to the upper octagonal room from the ground floor of the block-house. The roof is also octagonal, and finished to a centre pole, which forms the flagstaff. The upper story is the height of a man at the sides, and increases with the rise of the roof to the centre.

From this room the view over the harbor and lake is very fine. On each of the eight sides of the house there are port and loop holes for guns and rifles. The grave is at one side of the lower room, and the new slab which covers it is inscribed thus:—

Anthony Wayne,
Commander-in-Chief of U. S. Army,
Dec. 15, 1796,
Aged 52 Years.

What is left of the old coffin-lid is preserved in a frame, and covered with glass. The old inscription, made with flat-headed brass nails, can be legibly traced. The block-house contains nothing but this lid and the slab marking the grave. On the outside are four parrot guns, sent by the Secretary of War, at the request of President Grant. All are in the care of a custodian, who entertainingly

[1] Continued from page 114, number 584.

regales visitors with the abundant stories of olden times, when Mad Anthony whipped the Indians.

This monument is *unique*, and as interesting as the most exacting critic or admirer of Wayne could wish. It is more than a mere illustrative reproduction of a primitive fact; it is a forcible and artistic symbol, and, for its time and purpose, more vital than any higher symbol could possibly be. It brings back the stormy, trying days in which Wayne lived and fought, and when this old structure was a place of refuge, and a pillar of defense by night and day, for the early settler, against the merciless savage.

The Stockbridge Indian memorial and the Canonicus boulder belong to the same species of idea, though their suggestiveness is limited, while this is unlimited and comprehensive. It shows an appreciation for the dead, as rare as it is admirable. Contrast it with the prevalent ideas, or rather lack of ideas, seen in memorials in this country. It is not a museum, a town-hall, or a hundred-ton monstrosity from a granite yard.

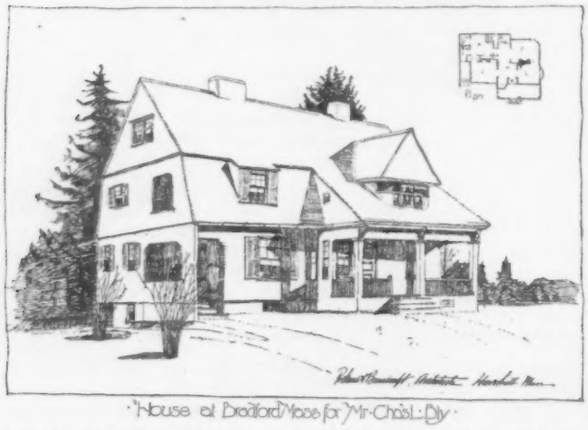
The modest way in which the committee speak of their work is also to be noted. "We wished to preserve the grave and memory of General Wayne, as the hero of Stony Point, and the beau ideal of the Revolutionary soldier."

If the projectors of the monument to Red Jacket would take the same point of departure as that acted upon by those who put up the Wayne memorial, they could add one more to the few worthy monuments of the country.

T. H. Bartlett.

[To be continued.]

DOMESTIC ARCHITECTURE IN JAPAN.



House at Bradford Moore for Mr Chas L. Ely

Mr. Josiah Conder. R.I.B.A. (*Soane Medallist*, 1876), left England ten years ago to become Professor of Architecture at the Technical College of Tokio, and also architect to the Japanese Government. He sent home, in 1878 and 1886, Papers on the Architecture of Japan, which are published in the *Transactions*, and his works at Tokio comprise residences for the Imperial Princes Arisugawa and Kitashirakawa, offices for the Imperial Household Department, the National Art Museum, portions of the new University Building, official residences, and other buildings. Mr. Conder, who is in England for a short time, read a paper before the Royal Institute of British Architects, February 28 last, and illustrated it with original drawings, and a model of a Japanese house.

In describing the domestic architecture of Japan, the author should, he said, have occasionally to allude to certain habits of life pertaining to the people of that country; some of them the rational results of climate, many of them closely associated with romantic tradition, but not a few belonging more to the passing than to the modern type of civilization. In Japanese houses separate rooms are not set apart for distinct and particular household purposes, as is the case in European dwellings. The bed-room, as a distinct apartment, can hardly be said to exist in the ordinary dwellings. As a general rule, any room is converted into a bed-chamber by spreading sleeping-quilts and pillows upon the matted floor. During the day-time such bedding is secreted in spacious closets arranged between the walls of the different rooms. The Japanese make constant use of the hot bath, and all the best houses are provided with a bath-room. The usual time for taking the bath is the afternoon or evening, so that the morning ablutions are simple, and are conducted, not in the sleeping-apartment, but in the lavatory, or, in some cases, even at the well-side in the garden, or kitchen court. Privies are provided at the end of the veranda passages, and just opposite to them in the garden is invariably an ornamental water-basin provided with a ladle. The mats, called *tatami*, used to cover the floors of all living-rooms, are of the fixed size of six feet by three feet, and rooms are described by the number of mats that they contain. Passages, verandas, part of the kitchen and the closets are boarded, such boarding quickly assuming a natural polish from the daily rubbing with wet cloths which it receives. Food is served to the different rooms upon small trays, one to each individual. In winter large metal-lined boxes, or bronze vases of live charcoal are placed in a room when in use, and in summer smaller fire-boxes are provided for lighting the pipe at. The candlesticks, or lamps used at night, one or two chests of drawers, small low tables for writing upon, boxes containing paper and ink, little shelves for the cups, and occasionally, in the most luxurious dwellings, a small lacquered cabinet, and a screen or two complete the furniture of an ordinary house. In every house, one room or more will be provided with an alcove or recess, called *tokonoma*, and a corresponding recess, occupied either by ornamental shelves, or by a closed store-closet.

The general mode of living in a Japanese house being understood, it would be easier, the author said, to appreciate the different arrangements which the builders have produced for administering economically to such wants. He showed a drawing of a small middle-class house, and another of a somewhat larger one-story building, formerly occupied by a private gentleman of the upper class. The former contains a vestibule, a small three-mat ante-room, one large seven-mat room, another room of six mats with a *tokonoma*, a kitchen, closets, privy, and back entrance. Such a dwelling would be surrounded on two sides by a little garden, containing a few shrubs, evergreens, stones of irregular shape, perhaps a stone garden-lantern and a hill or two. A small miniature pond might also be introduced. The whole would be surrounded by a garden fence, entered through a picturesquely-roofed wicket-gate. The internal constructional woodwork and the boarded ceilings of such a house would be carefully selected, and some pale neutral tint would be given to the plastering. The *ramma*, or frieze space, would be filled in with thin planks of clean wood, having some quaint pattern cut through, free or conventional. The other drawing shown was a good example of the best class of house, secondary only to the large summer pavilions of the nobles and their old feudal mansions. The approach is under a porchway paved with cement, having a high wooden step leading to the enclosed matted hall, four mats in area. At the side of this hall is a three-mat room for domestics, with large and small closet. The hall opens into a small inner hall or lobby of two mats, communicating with one of the principal sitting-rooms of eight mats in area; and at the back with an inner gallery which surrounds a central court or garden. On the right of this garden is a wing containing kitchen, servants' hall, and bath-room; and this wing, towards the front, adjoins the room devoted to hall-servants, though somewhat set back from the main frontage of the house. Beyond the eight-mat room mentioned is the principal room of the house, fifteen mats in area, and decorated at the farther end with an ornamental recess (*tokonoma*), and decorative shelves (*tana*). Behind this room, and forming a group on the farther or west side of the inner garden, are four smaller rooms, one eight mats, and the others six mats in area; of this group one has a *tokonoma* and *todana*, or closet, and the others closets only. At the back of the whole residence is an oblong block containing a large store and two small rooms for female servants, with separate entrance. As is almost invariably the case in the best houses, the principal rooms form an internal angle towards the garden, which is generally on the south side of the building. The whole of this side has a boarded veranda with a latrine at the end. Other conveniences are provided, one near the bath-room, and one at the back of the farther block. A house such as this would be provided with an extensive garden on the south and west sides, and a small garden of different character in the internal court or area. The style of garden employed within would be what is called the Hakeniwa, a flat garden of beaten earth, kept slightly damp and cleanly swept, dotted with quaint paths of stepping-stones, and rather thickly planted with low trees and shrubs. The outer garden would be of more free and open character belonging to what is called the *Sansui* type, a word implying mountain and water scenery; and designed to suggest some natural landscape.

The refined Japanese gentleman of the old school generally boasts some acquaintance with the philosophy and ceremonial of tea-drinking, and will adorn his grounds with one of those curious little buildings, called *Chashitsu*, intended for the preparation and enjoyment of this refreshing beverage, amid the hospitable formalities with which the pastime is surrounded. The construction of these buildings is in keeping with the tinyness of the arrangements, and the most exquisite care and neatness is displayed. The author showed a plan of one of these buildings designed by the greatest professor of the *Cha-no-yu*, Sen-no-Rikiu, and described its arrangements and construction in detail.

Numerous types of houses used by the upper classes might be given, but the one previously described was sufficiently characteristic. The time at the author's disposal did not admit of his describing these at length, nor of reading all that he had written on the subject of the *Yashiki*, or town residences of the territorial nobility; and of the castle-palaces. The latter consist of an extensive group of one-storied buildings compactly arranged, and divided at intervals by inner courts or small gardens. The principal palace of the latest *Shogun*, or Military Regent, in the Castle of Yedo, which was years ago burnt to the ground, covered an area of more than two acres. The military character of such buildings necessitated greater compactness in planning than was adopted in the imperial palaces; and whereas the latter, as may be seen in Kyōtō, consist of a number of almost detached blocks connected by long covered ways, the former were more under one roof, the succession of rooms was less broken, and the inner courts and gardens were introduced only where absolutely necessary for purposes of light and ventilation. In the matter of internal decoration, however, the castle palaces are far more gorgeously embellished than those of the imperial buildings. The *ramma* are elaborately colored and gilt, the ceilings have painted silk

panels and lacquered frames, and the only undecorated portions are the posts and lintels, which are invariably of plain white wood. . . .

The whole of the imperial buildings are, without exception, of one story only, and present very few striking architectural features on the outside. The roofs are of picturesque curve, though decidedly heavy looking, and are covered with thick layers of pine shingles. Terminals and ridges are executed in wood, covered with copper-plate, and with a little gilding in parts. The gables have barge-boards and carved pendants. The eaves, with the exception of those of the Shishinden, have not the rich bracketed cornices generally found under them in temple buildings, but are much simpler.

The principal features of interest upon the exterior, are the elegant balustrades and hand-rails of the external galleries and staircases, and the wooden screen divisions which separate the verandas into parts. The vista of interior rooms, always seen from the outside, attaches interest to an otherwise bare and monotonous elevation. . . .

No Japanese roof is of one continuous slope. It has a steep pitch towards the top, becoming flatter towards the eaves. The two slopes combine in a slight parabolic curve. These roofs are themselves of extreme weight, and, when covered with snow, the weight, as Mr. Hansard surmised, is very great; but you must bear in mind that in Japan the idea of carrying the whole weight of your roof on the external walls by means of ties, stays, and so forth, is not followed. The roof is supported from as many points in the interior of the building as possible. The roof, in fact, consists of a number of partition-walls, whose heads have been cut off to the slope required, so that the weight is considerably spread over the area. With regard to the *Amado*, or rain-shutters, the Japanese house, in a storm, is rather a noisy place to be inside of. The shutters rattle, and it is necessary that they should all be tightly fastened up to prevent the risk of one or two of them being blown out. But the whole building cannot boast of any great solidity, so that the shutters are, perhaps, as well off as any other part. With regard to the glass, I may state that since glass was introduced it has become usual to use it a good deal in place of paper. If the slides, which run round three sides of the house, were filled up with glass, what a bleak and bare feeling the rooms would have! This feeling is somewhat relieved by having a partially opaque paper between you and the outside, so that the effect of introducing glass into Japanese buildings, although practically it may exclude the air and wet a little better, is rather a drawback than otherwise. A kind of compromise is often used by making the central pane only of glass and leaving the remaining ones of paper. The Japanese originally took their architecture, as well as all their arts, from China, and many modifications have taken place in this style as introduced from China, but changes have also taken place in China. The result is that the present Chinese style is very different from the Japanese, but it is difficult to know exactly how much the present Japanese style is like the old style in China, which Japan first took from that country. It is probable that in those old times the Chinese style was also a wooden one. As you know, China now uses, to a great extent, more solid materials. The pagodas which in Japan are invariably of wood are in China built of brick, and very often coated with porcelain. . . .

I maintain that there is nothing in the construction of Japanese buildings in any way to make them suited to earthquakes. They are, seismologically, exactly the opposite of what earthquake structures should be; they are extremely top-heavy to begin with; they have no diagonal ties nor any braces whatever. In the earthquake shocks, with which, in Japan, we are familiar, these buildings sway about palpably in the most alarming manner, and no builders or architects of the old style that I have met with have ever, in any way, laid claim to earthquake advantages in their designs. That is a curious matter in respect of the pagoda posts which I know was fully discussed before. My opinion is that the central post was put up in the pagoda to stiffen it against wind, and to contribute to its general stability. It certainly does not act as a pendulum. The pagoda is a structure which you may liken almost to a cardboard house. You know the manner in which a house is built of cards by placing two cards vertically, and then others over them in a slanting position, and repeating the operation to several stages. That is somewhat the way in which the Japanese pagoda is constructed. The central post is necessary as a stiffener to the whole. There are, however, cases in which these central posts do not quite touch the ground. The reason for this I have scientifically explained in former papers and in letters, so that I will not take up your time by resuscitating this subject.

A Natural Electric Rock.— A very peculiar property has recently been discovered in the rock of a mountain seven miles from Santa Cruz. This rock is heavily charged with electricity, and when applied to a battery was found to produce strong electric currents. A small handful of this rock applied in a battery generated sufficient electric force to operate the battery for three weeks, and appeared not to be the least exhausted of its powers. This rock has very much the appearance of ordinary soapstone, and exists in immense quantities, constituting the principal mass of the mountain. Its strange property was accidently discovered by a man who was experimenting with mineral-water on the mountain, and who, having occasion to use some of this rock, placed it in contact with the battery. The man who made this wonderful discovery kept it a profound secret from the world until he and one or two of his confidential friends had obtained a title to the portion of the land, paying $15,000 therefor. The present owners are now experimenting with this rock with a view to thoroughly testing its properties. — *Iron.*

THE LATEST STEP IN CIVILIZING JAPAN.

Ever since the bright little empire of Japan started upon the course of modern progress its rulers have lost no opportunity of springing surprises upon the outside world, writes a correspondent at Tokio to the *New York Tribune*. Most of these have proved to be naturally and properly connected with a definite system of development, however contrary to the national traditions they may have originally appeared. The adoption of the Gregorian calendar, for example, could have been undertaken only by a government thoroughly confident in its own strength and well assured of the docility of its subjects. It was as unwelcome to the mass of the people as any possible change could be, but it afforded a striking evidence of determination to bring the country into more direct accord with European and American ideas. The order requiring all government officials to wear foreign clothes seemed at first arbitrary and trivial; but its enforcement relieved the Japanese diplomatists from much of the impertinent curiosity to which they had been subjected, and greatly simplified the conditions of their intercourse with strangers. Each year has witnessed innovations, political as well as social, the announcement of which has excited general astonishment, not to say anxiety. In almost every instance, however, the measures have resulted satisfactorily, and the apparently rash experiments have turned out to be short cuts in the direction of practical and substantial reform.

There are occasions, nevertheless, when it seems impossible to reconcile the government's proceedings with any rule of discretion or sound judgment. Ancient usages are assailed and overthrown, not under stress of necessity, not from consideration for the popular welfare, but, so far as can be discovered, from some motive scarcely compatible with the country's true interests. A movement of peculiarly radical sweep, to which no person can attribute a sufficient cause, is at this moment agitating the entire body of Japanese society, throwing one sex into excitement and bewilderment, and spreading dismay through the ranks of the other. The Empress has emerged from her conventional seclusion, and, in a document which certainly has no precedent in Oriental history, has signified her will that the women of the empire shall put aside their customary dress — the dress of their ancestors from time immemorial — and adopt that of the remote West. That a Japanese Empress should address her subjects on any topic is marvellous enough. That the national costume should be her topic is more marvellous, and that she should recommend this remarkable substitution is most marvellous of all. In fact, however, her majesty is in no direct sense responsible for the transaction. It is purely an affair of State, which has occupied the attention of that supreme circle of councillors, known as the Dai Jo Kuwan, for at least five years. Ever since 1882 this austere assemblage has been industriously and ardently studying the question of dress-reform. The libraries of the Senate House have been loaded with fashion prints and periodicals from Paris, and the ante-chambers filled with mysterious structures of wire and whalebone, the aspect of which might have awakened unfair suspicions that a return to the barbarities of punishment by torture was contemplated. Whatever may be the underlying purpose of the impending change, it will not have been instituted without ample deliberation. The extent to which the investigations have been carried, and the methods employed, would form an amusing chapter of Eastern court records, if the details could be unreservedly revealed.

Whether the august gentlemen who govern Japan held it beneath their dignity to appear as the originators of the project, or whether they doubted their own authority in so delicate a matter, must be left to conjecture. Having decided what was to be done, they took the discrete, if not altogether valorous, course of communicating their intention through the mouth of the Empress, whose person is dear to all in Japan, and whose words would be sure, in almost any case, to command respectful obedience. Her proclamation was issued at the beginning of this year, and before the holiday festivities were over the ladies of the capital were rivalling each other in the most extravagant efforts to conform to its admonitions. The results of their struggles are not yet apparent, but it goes without saying that they will make a dreadful mess of everything, and when the newly-ordained fashion extends all over the land, the consequences will be distressing. Nothing could be more dainty, graceful, and becoming than the familiar garb of the women of Japan. If not in all particulars a model of convenience and comfort, it is in those respects far superior to the style by which it is to be replaced. The freedom and ease which its wearers have enjoyed must now be exchanged for a constraint to which they cannot become accustomed for generations. They will not only suffer in the flesh themselves, but will be cause

of suffering in the spirit to others, for they will be hideous to behold. The idea of accommodating their frames to the incoming modes cannot be grasped by them. With many advantages of form, especially in the upper part of the body, they have certain defects which will be cruelly aggravated by the uncongenial attire. Not one in a thousand will know how to walk, for the peculiar gait which has been established and confirmed by centuries of habit will cling to them as long as they live. Undoubtedly there may be exceptions; but every one conversant with the subject knows how rare they must be, and can testify that the very prettiest of Japanese girls is apt to be transformed into an apish counterfeit of gentle humanity when she arrays herself in anything but the pliant and picturesque native robes. That the novel apparel will be accepted willingly, and even with enthusiasm, is very possible, for the mere name of fashion has a spell of fascination which no woman in any corner of the earth can easily resist; but it must be accepted at the cost of the power to charm for many a year to come.

As for the men of Japan, there is nothing that can make the change tolerable to them. In the first place, the expense will be a crushing weight. Half a dozen feminine costumes, though of the most commonplace description, would exhaust the revenue of an ordinary Japanese for a year. It may be set down as a certainty that the great majority will find it impracticable to comply literally with the requirements of the edict. The real foreign vestments being unattainable some sort of substitute must be devised, the effect of which will probably be still more harrowing. In the large towns a moderate number of wealthy heads of families may supply their household goddesses with the proper material, and, perhaps, a suggestion of the proper style. But it will be a sorrow and a shame to them to see their wives and daughters thus arrayed, especially on occasions of ceremony. The European "dress of rigor" is an abomination to the eye of all Japanese men. In their estimation a woman might as well appear stark naked before the public as expose herself in its scanty folds. This, also, was the conviction of the women up to the close of 1886. Since then the Empress has spoken. The Empress decrees fashion, and fashion mocks at antique prejudices. They will harden their sensibilities, and the objections founded on scruples of delicacy will not long survive.

ILLUSTRATIONS

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE PARK AT UYENO, JAPAN.

[Gelatine Print, issued only with the Imperial Edition.]

"No traveller should fail to visit Uyeno. Originally the Tō-dō family, the property thus named was taken over by the Shōgun Iye-mitsu, in the year 1625, for the purpose of erecting here in the northeastern (and, therefore, according to a prevalent superstition, the most unlucky) portion of the new capital a series of Buddhist temples that should surpass all others in splendor. The original main temple then raised stood in front of the site of the present museum buildings, and was burnt down in 1868 when a bloody battle was fought between the Imperialists and the supporters of the Shō-gun's government. It was indeed one of the chief triumphs of Japanese architectural skill, and was considered the metropolitan of all Japan. The high priest, always a son of the reigning Mikado, was kept here for political reasons, as it was convenient for the Tokugawa rulers to have in their power one who could at once be decorated with the Imperial title if at any time the court of Kiōto should prove unfavorable to the policy of the Shō-gunate. The last high priest of Uyena was thus raised to the throne by the Shōgun's partisans, and carried off by them to Aidzu; but on their defeat was pardoned by the present legitimate sovereign, and sent to Germany to study. He is now known by the title of Prince Kita Shirakawa. The park, in which stand such of the temples as still remain, has been made public, and is, together with Mukō-Jima, the chief show-place for the cherry-blossoms, all Yedo assembling here to admire them on fine afternoons in the beginning of April. . . . Returning to the main road, the visitor has on his left the shallow lake known as Shinobazu-no-Ike, celebrated for the beauty of its lotus flowers in August. On the peninsula which juts out into it are a number of tea-houses and a small temple in Riō-bu Shin-to style dedicated to the goddess Ben-ten, and founded by Ji-gen Dai-shi." — *Murray's Hand-Book of Japan.*

JAPANESE ARCHITECTURAL DRAWINGS.

We reproduce, as a matter of interest, when taken in connection with Mr. Conder's paper, published elsewhere in this issue, detached specimens of a series of original working-drawings prepared as samples of Japanese architectural drawing, under the direction of the Japanese Department of Education, and by it shown at one of the recent exhibitions in London. We are given to understand that, complicated as these drawings appear, there is probably no ordinary village carpenter in Japan who could not understand them and follow their instructions. The way in which these drawings are folded up into the form of the common Japanese pamphlet show that our own tracings of working-drawings might be mounted and folded in the same way, and thus become more easy to handle and be more accessible as to their contents than the ordinary roll of tracings, which with such persistent vexatiousness never will stay open.

DESIGN FOR AN EPISCOPAL CHURCH. H. HOPPIN, ARCHITECT, PROVIDENCE, R. I.

The accompanying sketch is one of the designs made for a small Episcopal church near Providence. Outside to be covered entirely with rough shingles, oiled. Trimmings painted a dark bluish-gray, and roof stained to a darker shade of same color.

EPISCOPAL CHURCH, KENNEBUNKPORT, ME. MR. HENRY PASTON CLARK, ARCHITECT, BOSTON, MASS.

GATEWAY AND TEMPLE, YOMEI, NICCO, JAPAN.

DESIGN FOR A CITY HOUSE. MR. H. GILLETTE CLARK, ARCHITECT, NEW YORK, N. Y.

UNITED STATES GOVERNMENT BUILDING PRACTICE.[1] — III.

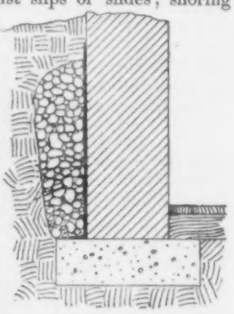
Drawings. — It is necessary to state that the drawings generally for all classes of work should show so clearly every portion of the work to be put under contract, that there can be no mistake about any dimension, or as to what kind of materials are intended; and the specifications are drawn taking for granted that such is the case with the drawings.

EXCAVATING.

Clearing the Site. — The Government will remove any building, rubbish, etc., that may be on the site, and will lay out the plan of the building on the ground, and give the contractor the lines, levels and stakes necessary.

The drawing for excavating locates the building upon the lot and shows the extent of the general and trench excavation, and the various depths to which they are to be carried.

Excavating. — The general excavation for basement areas, steps, etc., to be made of the dimensions noted on the drawing; the sides to be cut to the incline shown and the bottom made level; the trenches for foundations, footings, etc., to be the widths and depths noted, the sides cut plumb and the bottoms perfectly level; all earth to be removed from the premises, except such as may be wanted for filling-in, which must be deposited at some place to be designated by the superintendent. The bottoms of all trenches must be truly levelled, properly stepped where necessary and as shown; and if at any point after the depth of trench indicated by drawing is reached, solid ground is not found, the excavation must be continued until, in the judgment of the superintendent, a sufficiently stable foundation is obtained. The contractor must also prepare and keep open all trenches necessary to keep surface-water from running into trenches of foundations or into cellars. Should the pit be flooded with water, it must be removed (drained, if possible) at the expense of the contractor; all precautions to be taken against slips or slides; shoring to be provided and put up by the contractor wherever necessary, and all boulders, if any, to be removed.



Filling-in.—After walls are built, earth to be filled-in against them and packed solid to the required lines; all surplus earth not required for grading to be removed from the premises, and, at completion of contract, the grounds to be cleared of all rubbish, etc.

In damp soils against the outside of walls, below grade (if of brick, to be covered with asphaltum or coal-tar), small broken stones to be filled-in from top of concrete foundations to within one foot of grade line, the remaining space to grade line to be filled with earth rammed solid, and graded to take water away from building; outlets at the corners of building to be provided, for taking the water from these drains into sewers or elsewhere, away from the foundations.

[1] Continued from page 115, No. 584.

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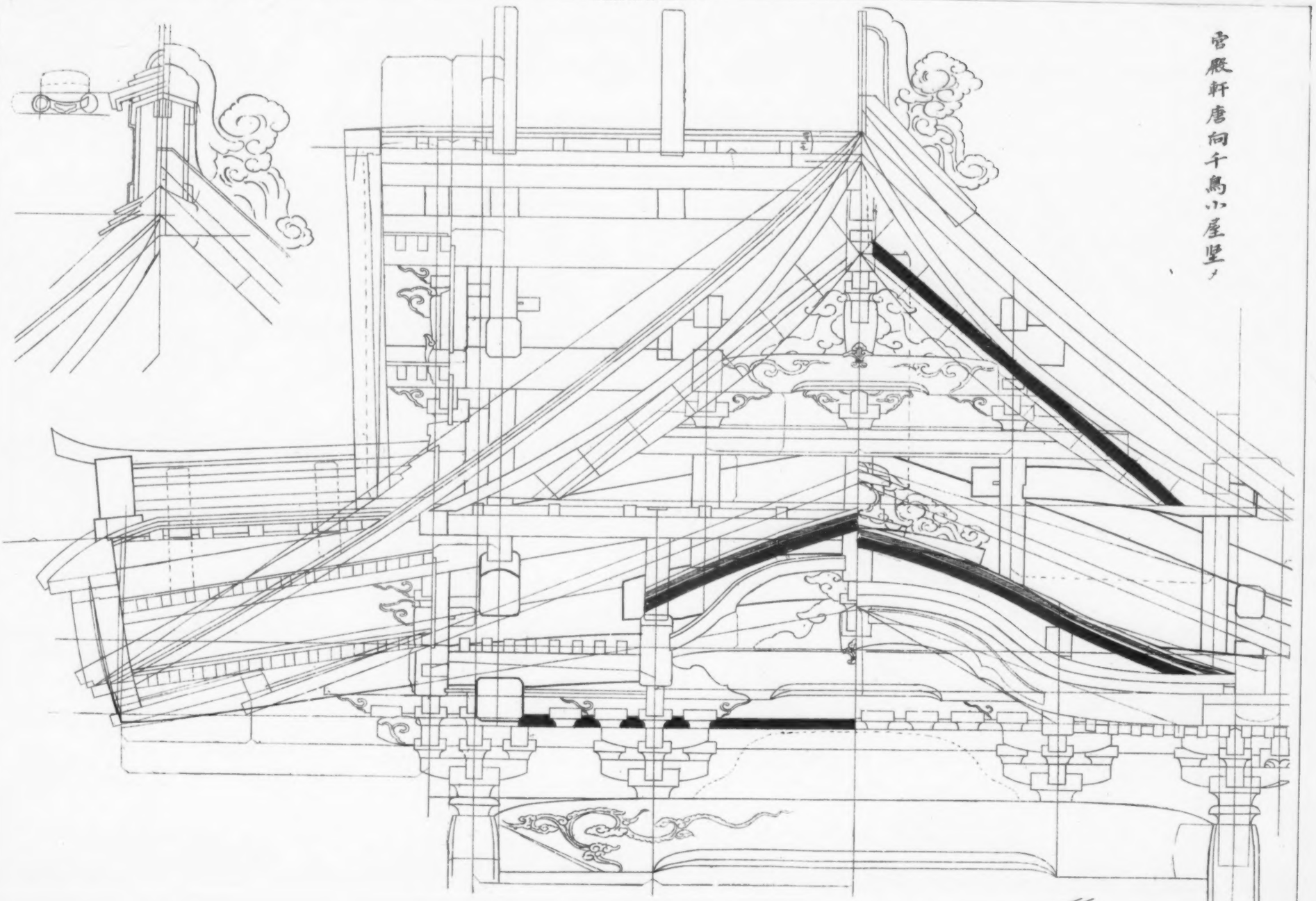

Specimens of
Japanese Working Drawings

Specimens of
Japanese Working Drawings.

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American Architect and Building News, Apr. 2 1887. No. 555

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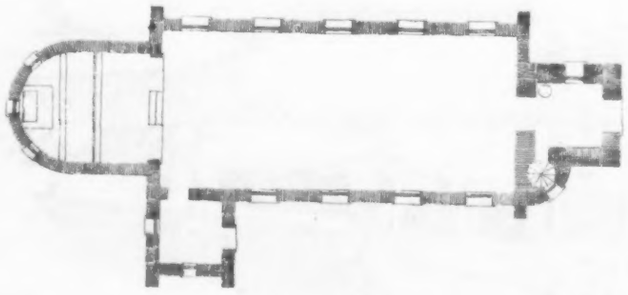
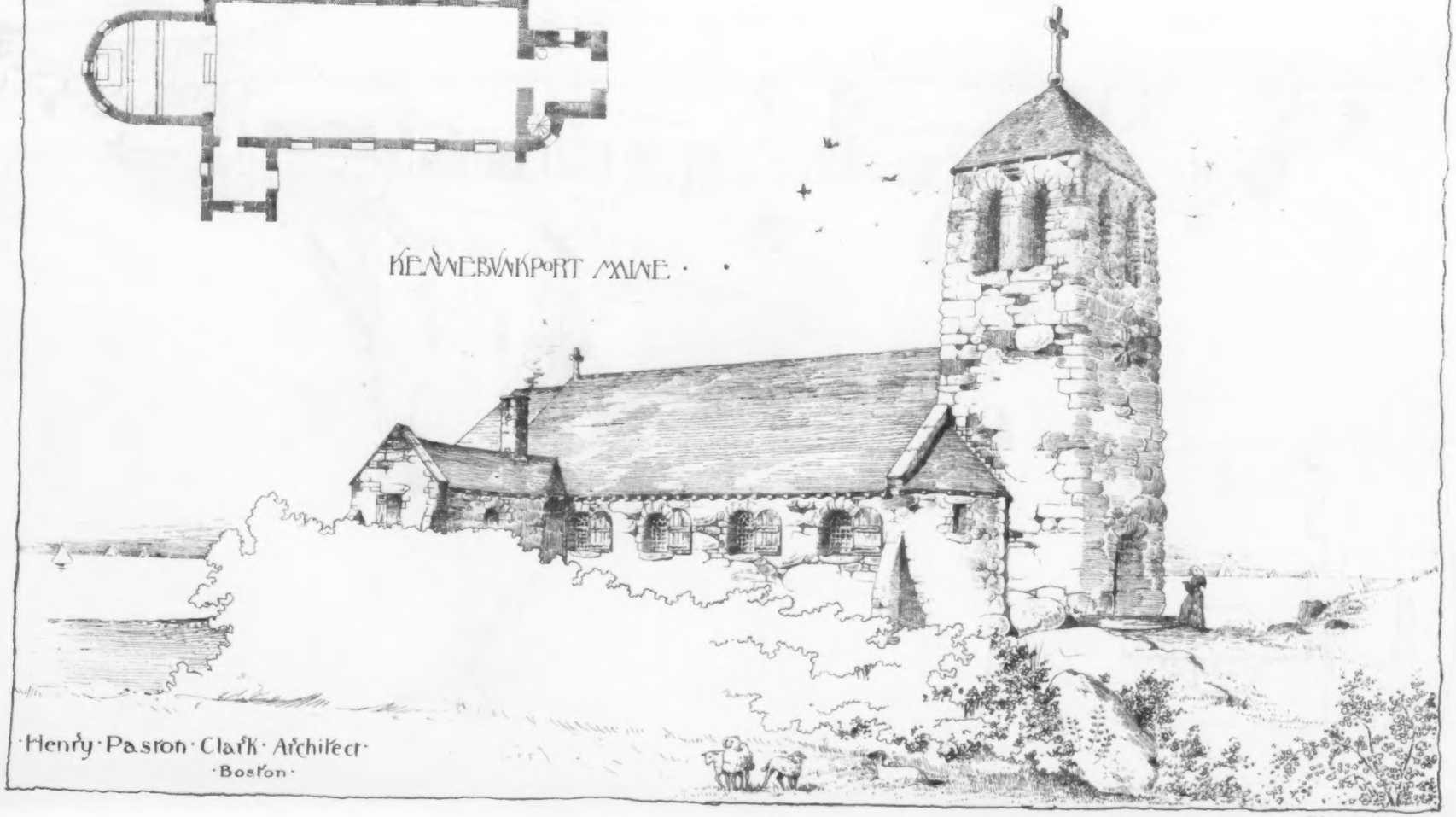
EPISCOPAL CHURCH



KENNEBUNKPORT MAINE



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Boston

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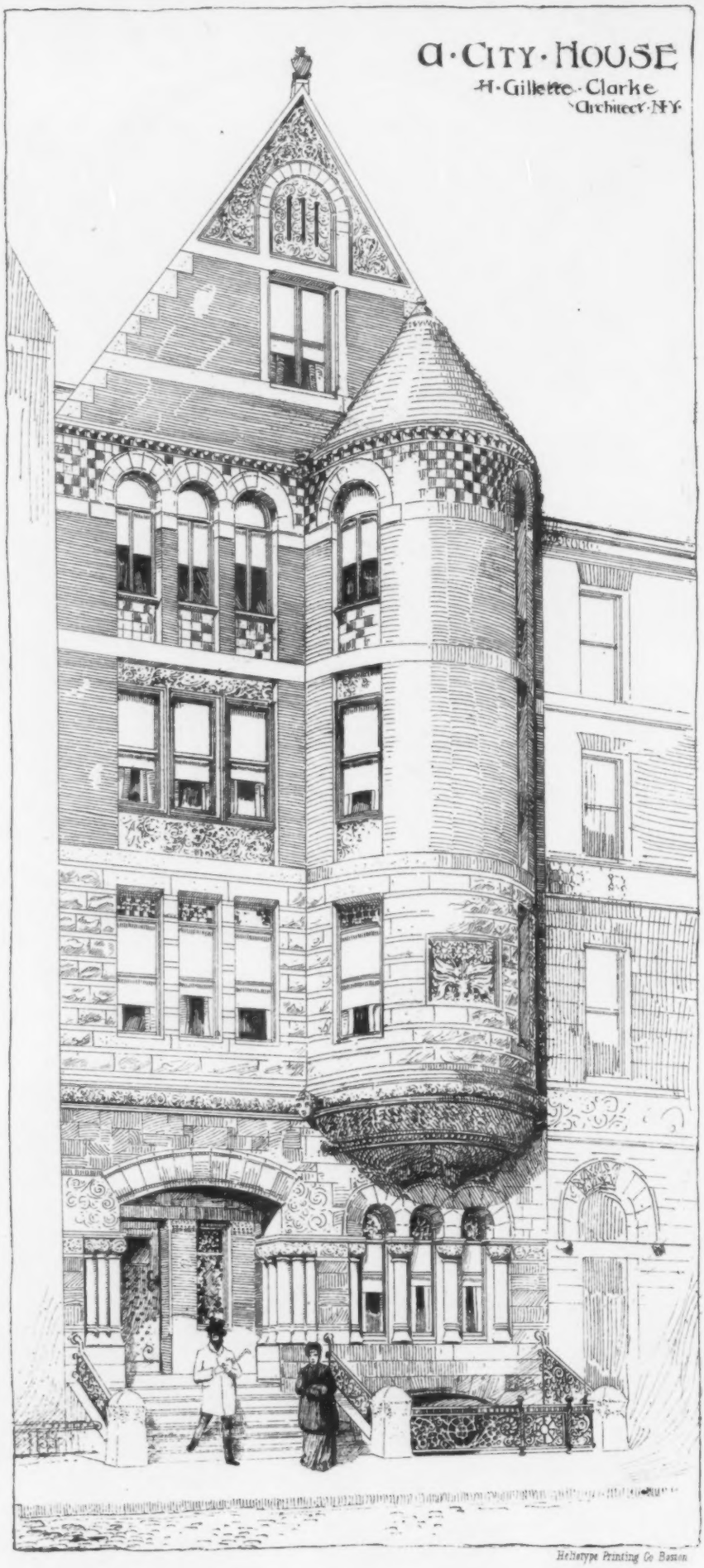
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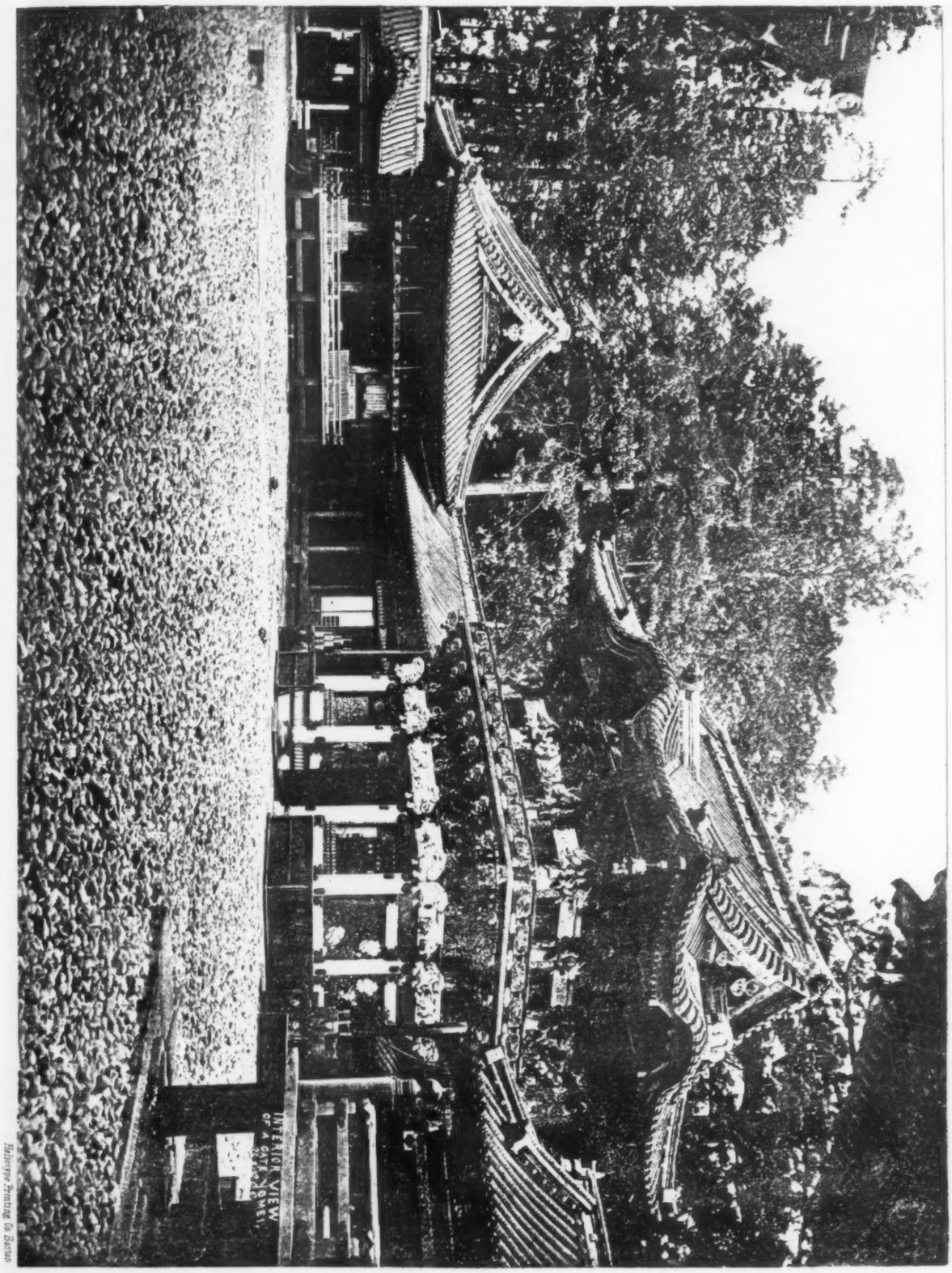


INTERIOR VIEW OF A CAFE ROYAL

Heliotype Printing Co. Boston

Grading and Terracing. — The lines of terracing and grades is shown on the drawing; all excavating and filling-in required to be executed, and any surplus earth or rubbish to be removed by the contractor; the grades to be so that water will run from the building, walks, etc., to the gutters or outlets. Arrow-heads show the direction in which the water is to run. Terracing should not be at a greater angle than 60°, and then it needs very careful sodding and attention until the sod has thoroughly taken root.

Soiling and Sodding — After the lot has been carefully graded and terraced to the required lines, the contractor to provide and fill in a soil four inches thick, of rich loam, and the sod, which must be of the best quality, freshly cut in sizes about twelve inches square (not over sixteen inches square), and must be neatly laid, breaking joint (the jointing to show as little as possible) and watered and maintained by the contractor until the sod has taken firm root and growth is assured. Where the grade of a terrace exceeds 40°, the sods should be laid horizontally in courses, each lower course projecting beyond the upper course, so there will be no risk of washing the sod out of place, before it gets firmly set.

MEASUREMENT.

Excavating is estimated by the cubic yards of earth in place before the ground is broken. The measurements are made from the drawing in feet, and the number of cubic feet divided by 27 gives the number of cubic yards; the length of the excavation or trench multiplied by the width, and this product by the height, giving the number of cubic feet.

Trench excavation, where accurate estimates are desired, should be estimated separately from the general excavation, because the ground for general excavation can frequently be broken by the plough, and a scoop used to get it out of the pit; whereas trench excavation can only be done with pick and shovel, and consequently costs a little more.

Filling-in with earth is estimated by the cubic yard, and costs about the same as general excavation, as the ramming is almost equal to the cost of breaking ground.

General excavation is considered to be all the earth to be removed from outside lines of foundations, and from the natural grade or surface of the ground to the bottom of foundation for basement floor; all below this plane is considered trench excavation.

Whenever any portion of an excavation is of different depth from another, it should be measured separately; the contractor should not depend on judgment for an average depth, where there is a wide margin for difference of opinion.

Where the natural surface of the ground is irregular, it is necessary to arrive at an average depth for the general excavation; this may be done in two ways: First, by dividing the entire area of the excavation into a number of equal rectangles, get the average depth of each rectangle, by adding together the depths of the four corners and dividing the sum by 4; adding the average depths of all the rectangles (truncated prisms) together, and dividing by the number of rectangles, will give the average depth of the entire excavation; multiplying the area by the average depth, gives the number of cubic feet in the excavation. The second, which is a more accurate, and frequently a shorter way, is to divide the area of excavation into unequal rectangles, locating the corners of the rectangles only at those points where the general surface changes, obtaining the average depth of each rectangle, as before, and multiplying by its area will give the cubic feet; adding together the cubic feet contained in all the rectangles thus obtained, will give the cubic feet in the entire excavation.

A cubic yard of earth before digging will occupy about $1\frac{1}{3}$ or $1\frac{1}{2}$ cubic yards when dug, and will average 21 cubic feet to the ton; sand, 22 feet; clay, 18 feet; and gravel, 19 cubic feet to the ton.

Grading and terracing are estimated by the square yard, giving an approximate depth of the excavating or filling required.

Soiling and sodding are estimated by the square yard.

COST.

The cost of excavating depends on rate of laborer's wages per day, the nature of the soil and the distance of cartage; it varies greatly in different parts of the country, averaging about 30 cents for general, and about 40 cents per cubic yard for trench excavation.

COST OF GENERAL EXCAVATION IN DIFFERENT CITIES.

Washington, D. C.	23 cts.	Baltimore, Md., in 1881	18 cts.
Montgomery, Ala., in 1881	25 "	Austin, Tex., in 1880	39 "
Hannibal, Mo., in 1884	12 "	Syracuse, N. Y., in 1884	30 "
Wichita, Kan., in 1886	15 "	St. Joseph, Mo., in 1885	35 "
Lynchburg, Va., in 1885	44 "	Leavenworth, Kan., in 1885	25 "

COST OF TRENCH EXCAVATION.

Wichita, Kan., in 1886	25 cts.	Paducah, Ky., in 1882	50 cts.
Nebraska City, Neb., in 1886	23 "	Louisville, Ky., in 1885	48 "
Lynchburg, Va., in 1885	65 "		

The cost of soiling and sodding varies from 8 cents to 15 cents per square yard.

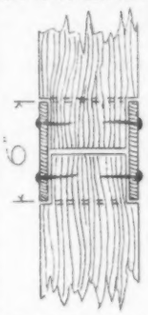
Piling. — The piling should be shown on the drawing for foundations, the distances from centres (not less than $2\frac{1}{2}$ feet), should be figured, and the locations properly shown; and where any portion of the foundation requires longer piles than another, the lengths of the piles for the different portions should be definitely shown and figured.

The methods used for determining the weights piles will carry do not differ from those in ordinary practice, and as it is not intended to give calculations for strains, etc., in these articles, need not be considered here, except to say, that where piles are driven to hard-pan, their resistance or bearing capacity is calculated the same as for posts. Where their resistance depends upon friction against the sides, and this is by far the most common case for piles, the best established rule for determining the safe load on each pile is: Multiply the weight of the ram in pounds by the height of fall in inches, and divide the product by the set in inches at the last blow (assuming that a factor of 8 is sufficient), one-eighth of the above result will be the safe load in pounds on each pile.

Although the above rule is the one most commonly used and generally accepted, it is not always reliable. An experienced engineer, who has driven miles of piles for railroads, piers and buildings, says he has spent much time in experimenting and trying to formulate a reliable rule for all kinds of soils, but so far has not succeeded; and considers the safest guide is to follow the judgment of experienced pile-drivers in each locality after careful tests have been made on the site.

Piles may be of white-oak, pine, spruce or hemlock, preference being in the order mentioned, and may be from 10 inches to 15 inches diameter at the butt, when 25 feet long and under, and 15 inches to 18 inches diameter for piles 30 feet long and over.

After the general and trench excavation has been made, the piles are to be driven in the trenches in the positions shown on the plans.



Where hard-pan can be reached, the piles are to be shod with cast-iron shoes, and driven to a firm bearing-using followers or false piles if necessary; the false piles to be connected to tops of others by wrought-iron cylinders 6 inches long, securely spiked to end of each pile; where the head of pile cannot be driven to bottom of trench, it is to be cut off horizontally at that level. The heads so cut off to be the property of the contractor, and must be removed from the premises.

Where hard-pan cannot be reached, the piles to be driven until a ram weighing [blank] pounds, falling [blank] feet, will not drive the pile more than [blank] inches at the last blow (3 or more test blows to be given).

All piles to have wrought-iron rings, the full diameter of piles (2″ x $\frac{3}{8}$″ section of metal) at top to prevent splitting the piles by the blows of the ram, and to be connected longitudinallyand transversely by heavy timbers of width equal to diameter of pile, securely spiked or pinned into head of pile. Where piles are exposed to sea-water, they should be creosoted, coated with asphalt, or best of all, covered with copper to protect them from limnoria, ship-worms, etc.

DRIVING AND COST.

At Baltimore in 1881, pine piles 10 inches to 15 inches diameter at butt were driven until a 1200 pound ram falling 20 feet, drove the pile only $\frac{3}{4}$ inch at last blow, and cost furnished and driven: 6 feet long, $3.20 each; 10 feet long, $3.75; 15 feet long, $4.25; 20 feet long, $4.75; and 25 feet long, $5.25.

At Pittsburg in 1881, pine piles 12 inches to 15 inches diameter, and 15 feet, 20 feet and 25 feet long were driven until a 2400 pound ram falling 15 feet drove the pile $\frac{3}{4}$ inch at last blow; and piles 15 inches to 18 inches diameter, 30 feet, 35 and 40 feet long were driven until a 3000 pound ram falling 15 feet drove pile only 1 inch at last blow; and they cost 15 feet long, $10.70 each; 20 feet long, $13.60; 25 feet long, $16.50; 30 feet long, $19.40; 35 feet long, $22.00; and 40 feet long, $24.80.

For wharf at Charleston, S. C., creosoted yellow-pine piles, 12 inches diameter, 40 feet long were driven, until a 3000 pound ram falling 20 feet, drove pile only $2\frac{1}{2}$ inches at last blow (3 test blows given), and cost $15.75 each.

At Council Bluffs, Ia., in 1884, pine piles 12 inches diameter, 16 feet long, cost, $2.00 and $2.25 each, and 16 cents per lineal foot driven, making about $4.80 per pile driven.

Sheet or sheath piles are thin timbers driven in contact, filling the gaps between gauge piles, and are used in shoring up for excavations, bulkheading, etc.; they are from 2 inches to 4 inches thick, sharpened at end, and sometimes tongued and grooved, and have wrought-iron cap, which is removed after pile is driven; a guide timber is secured on top of the gauge piles, and the sheet piles driven down by it, and securely spiked thereto.

Sheet piling is estimated by the lineal foot, giving height and thickness of piles.

At Brooklyn, in 1885, sheet piling 2 inches thick, 11 feet high, cost per lineal foot $2.50, furnished and driven, and $1.40 if removed by contractor after six months.

JAS. E. BLACKWELL.

[To be continued.]

THE FRENCH TO EXCAVATE AT DELPHI.— M. Montholon, the French Minister, has concluded the negotiations commenced by his predecessor, Count de Mouy, who was an enthusiast on the subject of antiquities. As a result of their efforts Greece has given to France permission to excavate at Delphi for remains of the Temple.

SAFE BUILDING.—XIV.[1]

GRAPHICAL METHOD.

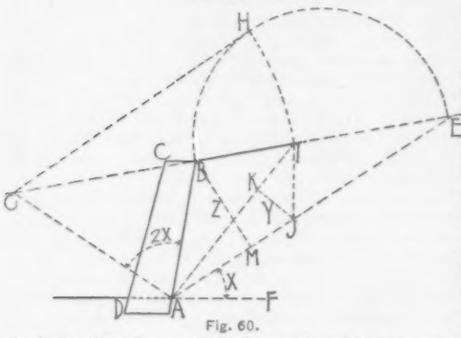


Fig. 60.

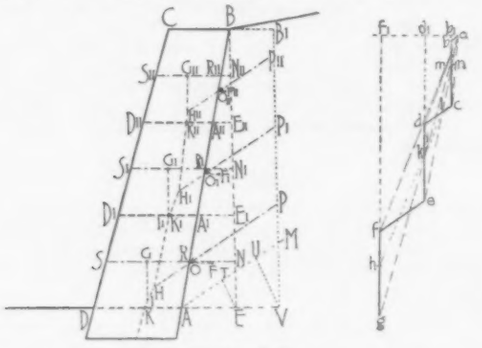
THE graphical method of calculating retaining-walls is much easier than the analytical, being less liable to cause errors, and is recommended for office use, though the analytical method might often serve as a check for detecting errors, when undertaking important work.

If A B C D is the section of a retaining wall and B I the top line of backing, draw angle F A M = x = the angle of friction, usually assumed at 33° (except for water); continue B I to its intersection at E with A M; over B E draw a semi-circle, with B E as diameter; make angle B A G = 2 x (usually 66°), continuing line A G till it intersects the continuation of B I at G; draw G H tangent to semi-circle over B E; make G I = G H; draw I A, also I J parallel to B A; draw J K at right angles to I A; and B M at right angles to A E. Now for the sake of clearness we will make a new drawing of the wall A B C D in Figure 61.

Calling B M = Z and K J = Y (both in Figure 60) make A E = Q (Figure 61) where Q is found from formula (57) following: —

$$Q = \frac{Y.Z.s}{L.m} \qquad (57)$$

Where Q = the length of A E in Figure 61, in feet,
Where Y = the length of K J in Figure 60, in feet,[2]
Where Z = the length of B M in Figure 60, in feet,
Where s = the weight of one cubic foot of backing, in lbs.
Where m = the weight of one cubic foot of wall, in lbs.
Where L = the height of backing, in feet, at wall.


Figs. 61 and 62.

Sections must have equal heights. Draw E B, divide the wall into any number of sections of *equal height*, in this case we will say three sections, A A_1 D_1 D; A_1 A_{11} D_{11} D_1 and A_{11} B C D_{11}. Find the centres of gravity of the different parts, viz.: G, G_1 and G_{11}, also F, F_1 and F_{11}. Bisect D D_1 at S, also D_1 D_{11} at S_1 and D_{11} C at S_{11}. Draw S N, S_1 N_1 and S_{11} N_{11} horizontally. Through G, G_1 and G_{11} draw vertical axes, and through F, F_1 and F_{11} horizontal axes, till they intersect A B at O, O_1 and O_{11}. Draw O P, O_1 P, and O_{11} P_{11} parallel to M A, where angle M A E = x = angle of friction of soil, or backing. In strain diagram Figure 62 make $a\ b_1 = R_{11}\ N_{11}$; also $b_1\ d_1 = R_1\ N_1$ and $d_1\ f_1 = R\ N$. From b_1, d_1 and f_1 draw the vertical lines. Now begin at a; draw $a\ b$ parallel to M A; make $b\ c = S_{11}\ R_{11}$; draw $c\ d$ parallel to M A; make $d\ e = S_1\ R_1$; draw $e\ f$ parallel to M A and make $f\ g = S\ R$. Draw $a\ c$, $a\ d$, $a\ e$, $a\ f$ and $a\ g$. Now returning to Figure 61, prolong P_{11} O_{11} till it intersects the vertical axis through G_{11} at H_{11}; draw H_{11} H_1 parallel to $a\ c$ till it intersects P_1 O_1 at H_1; draw H_1 I_1 parallel to $a\ d$ till it intersects the vertical axis through G_1 at I_1; draw I_1 H parallel to $a\ e$ till it intersects P O at H; draw H I parallel to $a\ f$ till it intersects the vertical through G at I; draw I K parallel to $a\ g$. Then will points K, K_1 and K_{11} be points of the curve of pressure. The amount of pressure at K_{11} will be $a\ c$, at K_1 it will be $a\ e$, and at K it will be $a\ g$, from which, of course, the strains on the edges D, D_1 and D_{11}, also A, A_1 and A_{11} can be calculated by formulæ (44) and (45). To obtain scale, by which to measure $a\ c$, $a\ e$ and $a\ g$, make $g\ h$, Figure 62 at any scale equal to the weight, in pounds, of the part of wall A A_1 D_1 D one foot thick, draw $h\ i$ parallel $f\ a$, then $g\ i$ measured at same scale as $g\ h$, is the amount of pressure, in pounds, at K. Similarly make $e\ k$ = weight of centre part, and $c\ m$ = weight of upper part, draw $k\ l$ parallel $d\ a$, and $m\ n$ parallel $b\ a$, then is $e\ l$ the pressure at K_1 and $c\ n$ the pressure at K_{11}, both measured at same scale; or a still more simple method would be to take the weight of A A_1 D_1 D, in pounds, and one foot thick, and divide this weight by the length of $g\ f$ in inches; the result being the number of pounds per inch to be used, when measuring lengths, etc., in Figure 62. The above graphical method is very convenient for high walls, where it is desirable to examine many joints, but *care must be taken to be sure to get the parts all of equal height*, otherwise, the result would be incorrect.

Scale of strain diagram.

If backing loaded. In case of a superimposed weight find w_1, as directed in formula (55), make A T at any scale equal to w and A U = w_1, draw T E and parallel thereto U V, draw V B, parallel to E B and use V B, in place of E B, proceeding otherwise as before. The points O of application of pressure P O, will be slightly changed, particularly in the upper part, as they will be horizontally opposite the centres of gravity of the enlarged trapezoids, and in the upper case this point would be much higher, the figure now being a trapezoid, instead of a triangle as before.

Buttressed walls. Where a wall is made very thin and then buttressed at intervals, all calculations can be made the same as for walls of same thickness throughout, but the vertical axis through centre of gravity of wall should be shifted so as to pass through the centre of gravity of the whole mass, including buttresses; and the weight of thin part of wall should be increased proportionately to the amount of buttress, thus: If a 12″ wall is buttressed every 5 feet (apart) with 2′ x 2′ buttresses, proceed as follows:

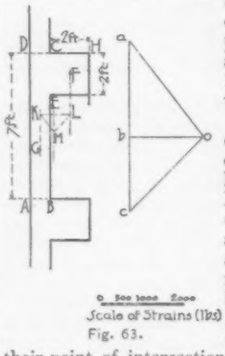


Fig. 63.

Find the centre of gravity G of the part of wall A B C D (in plan) Figure 63, also centre of gravity F of part E I H C, draw lines through F and G parallel to wall. Now make $a\ b$ parallel to wall and at any scale equal to weight or area of A B C D and $b\ c$ equal to that of E I H C. From any point o draw the lines $o\ a$, $o\ b$ and $o\ c$; now draw K L (anywhere between parallel lines F and G), but parallel to $b\ o$, and from L draw L M parallel to $o\ c$, and from K draw K M parallel to $a\ o$, a line through their point of intersection M drawn parallel to wall is the neutral axis of the whole mass. When drawing the vertical section of wall-part A B C D, Figure 64, therefore, instead of locating the neutral axis through the centre of wall it will be as far outside as M is from B C, in Figure 63; that is, at G H, Figure 64.

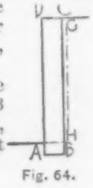


Fig. 64.

When considering the weight per cubic foot of wall, we add the proportionate share of buttress; now in Figure 63 there are 4 cubic feet of buttress to every 7 feet of wall, so that we must add to the usual weight w per cubic foot of wall $\frac{4}{7}\ w$, or $w.\ (1 + \frac{4}{7})$

To put this in a formula.

$$w_{11} = w\ (1 + \frac{a}{a_1}) \qquad (58)$$

[1] Continued from No. 584, page 117.

[2] If the incline of line B I to the horizon is equal to the angle of friction, as is often the case, find A G as before and use this length in place of K J or Y, which, of course, it will be impossible to find, as A M and B I would be parallel and would have no point of intersection; of course, B I can never be steeper than A M, or else all of the soil steeper than the line of angle of friction would be apt to slide.

GLOSSARY OF SYMBOLS.—The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.: —

a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_1 = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
$\mathfrak{D}$ = *diameter*, in inches.
$\mathfrak{r}$ = *radius*, in inches.
π = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle*.

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_1, a_{11}, a_{111}, etc., or b, b_1, b_{11}, b_{111}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance: —

m = moment or bending moment at *centre*.
m_A = " " " *point A*.
m_B = " " " *point B*.
m_X = " " " *point X*.
s = strain at *centre*.
s_B = " *point B*.
s_X = " *point X*.
v = stress at *centre*.
v_D = " *point D*.
v_X = " *point X*.
w = load at *centre*.
w_A = " *point A*.

Where w_1 = the weight per cubic foot, in pounds, to be used for buttressed walls, after finding the neutral axis of the whole mass.

Where w = the actual weight, in pounds, per cubic foot of the material.

Where A = the area in square feet of one buttress.

Where A_1 = the area in square feet of wall from side of one buttress to same side of next buttress.

Walls with counterforts. The buttresses, however, will not be of very much value, unless they are placed quite close together. Buttresses on the back surface of a wall are of still less value, unless thoroughly bonded and anchored to walls; these latter are called counterforts. It is wiser and cheaper in most cases to use the additional masonry in thickening out the lower part of wall its entire length.

Fig. 65.

Resistance to frost. Where frost is to be resisted the back part of wall should be sloped, for the depth frost is likely to penetrate (from 3 to 4 feet in our climate), and finished smoothly with cement, and then asphalted, to allow the frozen earth to slide upwards, see Figure 65.

Example I.

Cellar wall to frame dwelling. *A two story and attic frame house has a 12″ brick foundation wall, the distance from cellar bottom to ground level being 6 feet. The angle of friction of ground to be assumed at 33° and the weight per cubic foot at 120 pounds. Is the wall safe?*

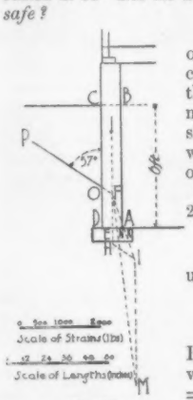


Fig. 66.

The weight of wall and superstructure must, of course, be taken at its minimum, when calculating its resistance to the ground, we shall, therefore, examine one of the sides on which no beams or rafters rest. The weight will consist, therefore, only of brick wall and frame wall over. We examine only one running foot of wall, and have

8 cubic feet of brick at 112 lbs.	=	896 lbs
24 feet (high) of frame wall at 15 lbs.	=	360 "
Total weight resisting pressure	=	1256 "

The pressure itself will be according to formula (52)

$$p = 16\tfrac{2}{3}.\ L^2 = 16\tfrac{2}{3}.\ 36$$
$$= 600 \text{ lbs.}$$

Now make D O = $\frac{4}{5}$. D C. Make angle P O C = 57°; prolong P O till it intersects the vertical neutral axis of wall[1] at F; make F H = 1256 pounds, at any scale, draw H I parallel to P O, and make H I = p = 600 pounds at same scale. Draw I F, then is its point of intersection K (with D A) a point of the curve of pressure, and F I (measured at same scale) is the amount of pressure p to be used in formulæ (44) and (45). By careful drawing we will find that K comes $\frac{1}{2}$″ beyond A (outside of A D), or 6$\frac{1}{2}$″ from centre E of A D. F I we find measures 1660 units, therefore p = 1660 pounds.

To find the actual stress or resistance v of edge of fibres of brickwork at A use (44), viz:

$$v = \frac{p}{a} + 6.\frac{x.p}{a.d}$$

and as p = 1660 and x = E K = 6$\frac{1}{2}$″ and a = 12. 12 = 144 inches and d = A D = 12″ we have:

$$v = \frac{1660}{144} + 6.\frac{6\frac{1}{2}.1660}{144.12} = 11\tfrac{1}{2} + 37\tfrac{1}{2} = +49 \text{ pounds}$$

as this is a positive quantity it will be compression.

The resistance of edge-fibres at D will be according to formula (45)

$$v = \frac{1660}{144} - 6.\frac{6\frac{1}{2}.1660}{144.12} = 11\tfrac{1}{2} - 37\tfrac{1}{2} = -26 \text{ pounds}$$

as this is a negative quantity D will be subjected to tension; that is, there is a tendency for A B C D to tip over around the point A, the point D tending to rise. The amount of tension at D is more than ordinary brickwork will safely stand, according to Table V, still, as it would only amount to 26 pounds on the extreme edge-fibres and would diminish rapidly on the fibres nearer the centre, we can consider the wall safe, even if of but fairly good brickwork, particularly as the first-story beams and girders and the end and possible cross-walls, will all help to stiffen the wall. Had we taken a foot-slice of the wall under the side carrying the beams, we should have had an additional amount of weight resisting the pressure. If the beams were 18 ft. span, we should have three floors each 9 ft. long and with load weighing, say, 90 pounds per foot; to this must be added the roof, or about 13 ft. à 50 pounds, the additional load being:

Floors,	3. 9. 90	= 2430
Roof,	13. 50	= 650
Total		3080

Now make I M = 3080 pounds at same scale as F H, etc., draw M F and its point of intersection N with D A would be a point of the curve of pressure, and F M, at same scale the amount of pressure on D A for the bearing walls of house; E N we find measures 2$\frac{1}{2}$″, and F M measures 4600 units or pounds. The stress at A, then, would be:

$$v = \frac{4600}{144} + 6.\frac{2\frac{1}{2}.4600}{144.12} = +72 \text{ pounds.}$$

and the stress at D would be:

$$v = \frac{4600}{144} - 6.\frac{2\frac{1}{2}.4600}{144.12} = -8 \text{ pounds.}$$

There will, therefore, be absolutely no doubt about the safety of bearing walls.

Example II.

Cellar wall deeper than adjoining building. *A cellar wall A B C D is to be carried 15 feet below the level of adjoining cellar; for particular reasons the neighboring wall cannot be underpinned. It is desirable not to make the wall A B C D over 2′ 4″ thick. Would this be safe? The soil is wet loam.*

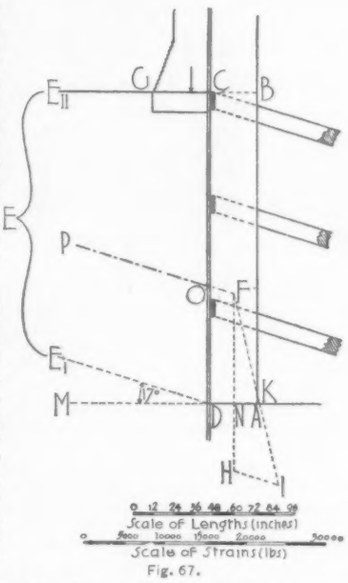


Fig. 67.

In the first place, before excavating we must sheath-pile along line C D, then as we excavate we must secure horizontal timbers along the sheath-piling and brace these from opposite side of excavation. The sheath-piling and horizontal timbers must be built in and left in wall. The braces will have to be built around and must not be removed until the whole weight is on the wall.

The weight of the wall C G, per running foot of length, including floors and roofs, we find to be 13000 pounds, but to this we must add the possible loads coming on floors, which we find to be 6000 pounds additional, or 19000 pounds total, possible maximum load. This load will be distributed over the area of C D E. In calculating the weight of A B C D resisting the pressure, we must take, of course, only the minimum weight; that is, the actual weight of construction and omit all loads on floors, as these may not always be present. The weight of walls and unloaded floors coming on A B C D, and including the weight of A B C D itself, we find to be 21500 pounds per running foot. Now to find the pressure p, proceed as follows: Make angle E_1 D M = 17°, the angle of friction of wet loam (See Table X), and prolong D E_1 till it intersects C E_1 at E. Now C E, we find, measures 52 feet; C D or L is 15 feet; then, instead of using w in formula (51), we must use W_1, as found from formula (55), viz.:

$$w_1 = w + \frac{2.19000}{CE.\ L}$$

w for wet loam (Table X) is 130 pounds; therefore,

$$w_1 = 130 + \frac{2.19000}{52.\ 15} = 130 + 48,\ 7 = 179.$$

Inserting this value for w in formula (51) we have:

$$p = 179.\ 15^2.\ 0,138 = 5558.$$

The height X from D of which P O is applied is found from formula 56, and is:

$$X = \frac{15.(179 - \frac{2}{3}.150)}{2.179 - 150} = \frac{15.(179 - 100)}{358 - 150} =$$

$5',697 = 5' - 8\frac{1}{2}''$

Make D O = X = $5' - 8\frac{1}{2}''$; draw P O parallel to E D till it intersects the vertical neutral axis of wall (centre line) at F; make F H (vertically) at any scale equal to 21500, draw H I parallel to P O and make H I = p = 5558 pounds at same scale, draw I F, then is its point of intersection with the prolongation of A D at K a point of the curve of pressure, and F I measured at same scale as F H is the amount of pressure on joint. The distance K from centre of joint N we find is 14$\frac{1}{2}$″, F I measures 23800 units or pounds; the stress (v) at A, therefore, will be, formula (44):

$$v = \frac{23800}{28.12} + 6.\frac{14\frac{1}{2}.23800}{28.12.28} = +292$$

While the stress at D would be formula (45)

$$v = \frac{23800}{28.12} - 6.\frac{14\frac{1}{2}.23800}{28.12.28} = -150$$

Or the edge at A would be subjected to a compression of 292 pounds, while the edge at D would be submitted to a tension of 150 pounds per square inch, both strains much beyond the safe limit of even the best masonry. The wall will, therefore, have to be thickened and a new calculation made.

Example III.

Wall to stage pit. *A stage pit 30 feet deep is to be enclosed by a stone-wall, 3 feet thick at the top and increasing 4 inches in thickness for every 5 feet of depth. The wall, etc., coming over this wall weighs 25000 pounds per running foot, but cannot be included in the calculation, as peculiar circumstances will not allow braces to be kept against the cellar wall, until the superimposed weight is on it. The*

[1] It should really be the vertical neutral axis of the whole weight, which would be a trifle nearer to D C than centre of wall.

surrounding ground to be taken as the average, that is, 120 *pounds weight per cubic foot, and with an angle of friction of* 33°.

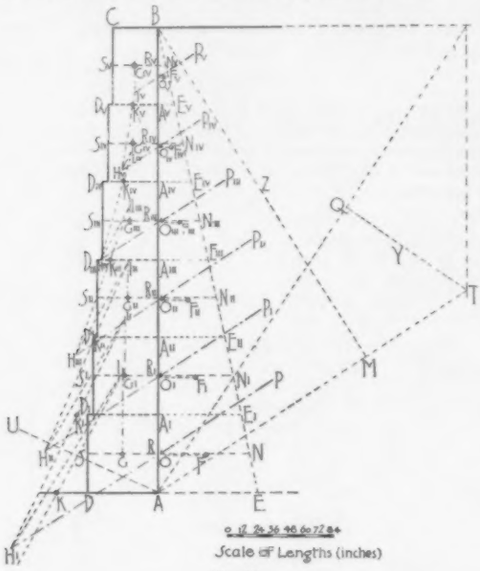


Fig. 68.

Find B M (= Z) and Q T (= Y) by making angles T A E = 33° and B A U = 66° and then proceeding as explained for Figure 60. We scale B M and Q T at same scale as height of wall A B is drawn, and find:

B M = Z = 25 ft. 6″ = 25½

Q T = Y = 9 ft. 8″ = 9⅔; assuming each cubic foot of wall to weigh 150 pounds we find Q from Formula (57)

$$Q = \frac{9\frac{2}{3}.\ 25\frac{1}{2}.120}{30.\ 150} = 6{,}573 = 6' - 7''.$$

Make A E = Q = 6′ — 7″ and draw B E.

At *equal heights*, that is, every 5 feet, in this case, draw the joint lines D E, D_i E_i, D_{ii} E_{ii}, etc. Find the centres of gravity F, F_i, F_{ii}, etc., of the six parts of A E B, (see foot-note, p. 117) and also the centres of gravity G, G_i, G_{ii}, etc., of the six parts of the wall itself, which, in the latter case, will be at the centre of each part.

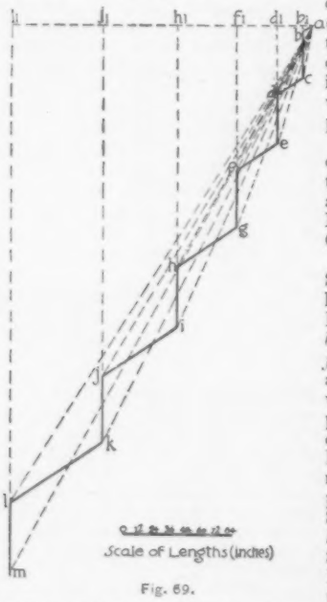


Fig. 69.

Horizontally, opposite the centres F, F_i, F_{ii}, etc., apply the pressures P O, P_i O_i, etc., against wall, and parallel to M A. Through centres G, G_i, G_{ii}, etc., draw vertical axes.

Draw the lines S N, S_i N_i, S_{ii} N_{ii}, etc., at half the vertical height of each section. Now in Figure 69 make $a\ b_i = R_v\ N_v$; $b_i\ d_i = R_{iv}\ N_{iv}$; $d_i\ f_i = R_{iii}\ N_{iii}$; $f_i\ h_i = R_{ii}\ N_{ii}$; $h_i\ j_i = R_i\ N_i$; and $j_i\ l_i = R\ N$. Draw the vertical lines through these points. Now begin at *a*, make *a b* parallel to P O, make $b\ c = R_v\ S_v$; draw *c d* parallel P O; make $d\ e = R_{iv}\ S_{iv}$; draw *e f* parallel P O, make $f\ g = R_{iii}\ S_{iii}$, and similarly *g h*, *i j* and *k l* parallel P O, and $h\ i = R_{ii}\ S_{ii}$; $j\ k = R_i\ S_i$ and $l\ m = R\ S$. Draw from *a* lines to all the points *c*, *d*, *e*, *f*, *g*, etc. Now in Figure 68 begin at P_v O_v, prolong it till it intersects vertical axis G_v at I_v, draw I_v H_v parallel *a c* till it intersects P_{iv} O_{iv} at H_v; draw H_v I_{iv} parallel to *a d* till it intersects vertical axis G_{iv} at I_{iv}; draw I_{iv} H_{iv} parallel to *a e* till it intersects P_{iii} O_{iii} at H_{iv} and similarly H_{iv} I_{iii} parallel *a f*; I_{iii} H_{iii} parallel *a g*: H_{iii} I_{ii} parallel *a h*; I_{ii} H_{ii} parallel to *a i*; H_{ii} I, parallel to *a j*; I, H_i parallel to *a k*; H_i I parallel to *a l*, and I K parallel to *a m*.

The points of intersection K, K_i, K_{ii}, etc., are points of the curve of pressure. To find the amount of the pressure at each point, find weight per running foot of length of any part of wall, say, the bottom part (A A_i D_i D) the contents are 5′ high, 4′ 8″ wide, 1′ thick = $5.4\frac{2}{3}.1$ = $23\frac{1}{3}$ cubic feet à 150 pounds

= 3500 pounds.

Divide the weight by the length of *m l* in inches, and we have the number of pounds per inch, by which to measure the pressures. As *m l* measures 56 inches, each inch will represent $\frac{3500}{56} = 62\frac{1}{2}$ lbs.

Now let us examine any joint, say, A_{iii} D_{iii}; I_{iii} H_{iii} which intersects A_{iii} D_{iii} at K_{iii} is parallel to *a g*. Now *a g* scales 166 inches, therefore, pressure at $K_{iii} = 166.\ 62\frac{1}{2} = 10375$ pounds. In measuring the distance of K_{iii} from centre of joint in the following, remember that the width of A_{iii} D_{iii} is 44 inches, the width of masonry above joint, and *not* 48″ (the width of masonry below). A_{iii} K_{iii} scales 38″, therefore, distance *x* of K_{iii} from centre of joint is $x = 38 - 22 = 16''$.

We have, then, from Formula (44)

$$\text{stress at } D_{iii};\ v = \frac{10375}{44.12} + 6.\frac{16.10375}{44.12.44} = +63 \text{ pounds.}$$

and from formula (45)

$$\text{stress at } A_{iii};\ v = \frac{10375}{44.12} - 6.\frac{16.10375}{44.12.44} = -23 \text{ pounds.}$$

The joint A_{iii} D_{iii}, therefore, would be more than safe.

Let us try the bottom joint A D similarly. I K is parallel to *a m*; now *a m* scales 480″, therefore, the pressure at K is $p = 480.\ 62\frac{1}{2} =$ 30000 pounds.

Now K is distant 53 inches from centre of joint, therefore, stress at D is $v = \frac{30000}{56.12} + 6.\frac{53.30000}{56.12.56} = +298$ pounds.

and stress at A is $v = \frac{30000}{56.12} - 6.\frac{53.30000}{56.12.56} = -209$ pounds.

The wall would evidently have to be thickened at the base. If we could only brace the wall until the superimposed weight were on it, this might not be necessary. If we could do this we should lengthen *b c* an amount of inches equal to the amount of this load divided by $62\frac{1}{2}$ (the number of pounds per inch), or *b c* instead of being 36 inches long would be:

$$36 + \frac{25000}{62\frac{1}{2}} = 436 \text{ inches long.}$$

While this lengthening of *b c* would make the lines of pressure *a c*, *a e*, *a f*, etc., very much longer, and consequently the actual pressure very much greater, it will also make them very much steeper and consequently bring this pressure so much nearer the centre of each joint, that the pressure will distribute itself over the joint much more evenly, and the worst danger (from tension) will probably be entirely removed.

Example IV.

Reservoir Wall. *A stone reservoir wall is plumb on the outside,* 2 *feet wide at the top and* 5 *feet wide at the bottom; the wall is* 21 *feet high, and the possible depth of water* 20 *feet. Is the wall safe?*

Divide the wall into three parts in height; that is, D D_i = D_i D_{ii} = D_{ii} C. Find the weight of the parts from each joint to top, per running foot of length of wall, figuring the stonework at 150 pounds per cubic foot, and we have:

Weight of A_{ii} B C D_{ii} = 2975 pounds.

Weight of A_i B C D_i = 7140 pounds.

Weight of A B C D = 12495 pounds.

Find centres of gravity of the parts A B C D (at G), of A_i B C D_i (at G_i) and of A_{ii} B C D_{ii} (at G_{ii}). Apply the pressures P O at ⅓ height of A E; P_i O_i at ⅓ height of A_i E and P_{ii} O_{ii} at ⅓ height of A_{ii} E, where E top level of water.

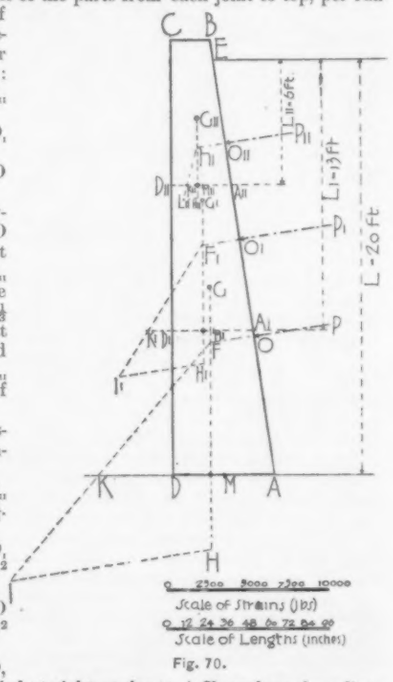


Fig. 70.

The amount of pressures will be from formula (53).

For part A_{ii} E; P_{ii} $O_{ii} = 31\frac{1}{4}$. $L^2_{ii} = 31\frac{1}{4}$. $6^2 = 1125$ pounds.

For part A_i E; P_i O_i = $31\frac{1}{4}$. $L^2_i = 31\frac{1}{4}$. 13^2 = 5281 pounds.

For part A E; P O = $31\frac{1}{4}$. $L^2 = 31\frac{1}{4}$. 20^2 = 12500 pounds.

The pressures P O, P_i O_i, etc., will be applied at right angles to A E, prolong these lines, till they intersect the vertical axes through (the centres of gravity) G, G_i and G_{ii} at F, F_i and F_{ii}. Then make

F_{ii} H_{ii} = 2975, weight of upper part.

F_i H_i = 7140, weight of A_i B C D_i, and

F H = 12495, weight of A B C D.

Draw through H, H_i and H_{ii} the lines parallel to pressure lines, making

H_{ii} I_{ii} = P_{ii} O_{ii} = 1125

H_i I_i = P_i O_i = 5281

H I = P O = 12500

Draw I_{ii} F_{ii}, I_i F_i and I F, then will their lengths represent the

amounts of pressure at points K_{u}, K, and K on the joints A_{u} D_{u}, A, D, and A D.

F_{u} I_{u} measures 3300 units or pounds.
F_{l} I_{l} " 9500 " "
F I " 18800 " "

By scaling we find that

K_{u} is $10\frac{1}{2}$ inches from centre of D_{u} A_{u}
K_{l} is 37 " " D_{l} A_{l}
K is 74 " " D A

The stresses to be exerted by the wall will, therefore, be

at D_{u}; $v = \frac{3300}{36.12} + 6.\frac{10\frac{1}{2}.3300}{36.12.36} = +21$ pounds.

at A_{u}; $v = \frac{3300}{36.12} - 6.\frac{10\frac{1}{2}.3300}{36.12.36} = -6$ pounds.

at D_{l}; $v = \frac{9500}{48.12} + 6.\frac{37.9500}{48.12.48} = +93$ pounds.

at A_{l}; $v = \frac{9500}{48.12} - 6.\frac{37.9500}{48.12.48} = -60$ pounds.

at D ; $v = \frac{18800}{60.12} + 6.\frac{74.18800}{60.12.60} = +219$ pounds.

at A ; $v = \frac{18800}{60.12} - 6.\frac{74.18800}{60.12.60} = -167$ pounds.

From the above it would appear that none of the joints are subject to excessive compression: further that joint $D_{u}A_{u}$ is more than safe, but that the joints D_{l} A_{l} and D A are subject to such severe tension that they cannot be passed as safe. The wall should, therefore, be redesigned, making the upper joint lighter and the lower two joints much wider.

Louis DeCoppet Berg.

[To be continued.]

HINTS FOR BUILDERS, OR USEFUL INFORMATION FOR BEGINNERS.—I.

IN undertaking the writing of the present series of articles, I have had in view the needs and requirements of the younger members engaged in the building and all the other trades intimately associated therewith — that is to say, the wants of apprentices and other young men who may desire to acquire something more than a mere perfunctory and rule-of-thumb knowledge of their profession, and whose extra knowledge will stand them in right good stead in such a land as the United States, and, although the ground I may traverse may, and possibly will be more or less familiar to many of my elder readers, still such will not be the case with those who have not advanced so far in life or their trade, for whom my papers are particularly written. For such there cannot ever be a beginning, and this being, I think, generally admitted, I have thought it advisable, in this series, to take my readers over the groundwork of the branches of the constructor's work, upon which I shall touch — giving them, in fact, a "wherefore" for a "why." Thus I shall, in the course of these papers, treat, more or less fully of masonry, bricklaying, drainage, mortars and cements, plastering, plumbing, carpentering, joining, flooring, warming, and ventilation, thus, I hope, taking those who may care to follow me — no matter to which branch of the building trade they may belong — over ground which, to become really efficient and intelligent workmen, they should travel, and which, I hope, they will not object to travel hand in hand with myself. With this brief introduction to my readers, I will proceed with my subject.

As in the construction of a house — be it a log hut or a hotel, a store or a mansion, the sanitary arrangements are all important. I shall deal first with the question of drainage.

DRAINAGE.

There is no subject of greater importance to the builder than that of drainage, and there is no question that a building well drained is half built, as on proper sanitary arrangements very much depends, not only as regards the structure itself, but as respects the health of its occupiers also. The question of drainage, beside that of effectually disposing of all sewage and waste water, also embraces irrigation, which is really the science of drainage as applied to land not intended for residental purposes, but as this phase of the question does not concern us, it will suffice to merely mention this fact, and then pass on to a consideration of the question as it affects the builder.

With respect to drainage as applied to sewering purposes, the Romans were undoubtedly far in advance of any other of the ancient nations, in proof of which their well executed and admirably conceived Cloaca Maxima still remains, as sound as the day when first put up, and still serving its original purpose. There is also no question that much valuable property has been lost in throwing the refuse of our towns into tidal rivers, where it has run to waste, beside causing much injury to the fish in the streams, and the inhabitants along their banks; and though we are gradually learning to utilize the sewage of our cities upon our lands, there is but little doubt that a great future is in store for our refuse, and that our rivers will be in days to come as pure and clean as they were wont to be in the oft-quoted "good old times." Of course, it is far easier to pick out defects in the various systems of the present day than to point out remedies, and as we have no wish to be embroiled in a heated controversy respecting the various methods of effective sanitation, we shall refrain from suggesting remedies, but simply confine ourselves to mentioning such things as every one engaged in the building trade should become acquainted with.

In the laying down of sewers, a primary necessity is to see that all the pipes have a proper fall, and this must be continuous, for if this be not done, the sewage, instead of flowing away, as it should do, will collect, and virtually a cesspool will be formed beneath the house, and become especially dangerous to the inhabitants. Of course the inclination and depth of all sewers must vary according to local circumstances and requirements — such as the "lay" of the land, buildings to be erected, and other features — but on no conditions should the fall be less than one-and-one-fourth inches to every ten feet. In laying the sewers for a city (supposing them to be of brick) be it large or small, devoted to residential or manufacturing purposes, the bricks employed in the building thereof should be good, hard, square, thoroughly sound, and well-burnt stock bricks, properly laid in well compounded mortar, the constituents of which should consist of one part of good strong stone lime, and two parts of clean and fine river sand, and the workmanship should invariably be of the best possible description. Should Roman cement be used, it must be of the best quality possible, and not more than half the quantity of clean river sand should be mixed therewith. Where practicable, cast-iron pipes are far preferable to brick-built sewers, owing to leakage being impossible, except at the joints, and not here if the work be properly performed. Brick-built sewers should not be employed, if it can possibly be avoided.

The main sewers receive the drainage of buildings by means of channels known as drains, which are generally of circular form, and varying from six to twenty-four inches in diameter, according to the requirements of the district. The lowest portion of the building to be drained should be as high as possible above the level of the sewer — in the vicinity of rivers, lakes or canals, at least six feet, measuring to the bottom of the side wall or commencement of the invert. If this preliminary precaution be not taken, the premises are liable to be flooded whenever the sewer is more than usually full, and such an accident is even possible when the sewers are flushed by artificial means. The bottoms of all house-drains should be at least twelve inches above the bottom of the sewer into which they run, while the fall should not be less than one-quarter inch for each foot. Thus to take a case in point, as a practical illustration for our younger readers, suppose the length of the house-drain to be sixty feet, the fall would amount to fifteen inches, which added to nineteen inches for the height of the drain itself, and the necessary brickwork, eight inches for the depth of the ground, and the paving over the upper end of the drain, and twelve inches between its lower end and the bottom of the main sewer, will give the total fall of four-and-one-half feet, which will give that for a small private residence. Of course in larger buildings, the dimensions would require to be enlarged. Where it is at all practicable, glazed stoneware or cast-iron pipes should be employed in preference to the brickwork sewers, as they are more easily and quickly laid than the others can be built, they present a much better surface for the rapid flow of the sewage, and they are less liable to leak, as, if properly jointed up, a leakage should be an impossibility. Also, seeing the comparative thinness of these pipes a much larger capacity is obtained, with a given quantity of excavation for laying them than in brickwork sewers, which at the lowest, cannot be less than four inches (half-a-brick) in thickness. Builders should therefore bear this ever in mind.

In designing a house, the architect should see that the water-closets, sinks, and other receptacles for waste water and sewage are at the back of the house, and that the drains are at the back also; but should the drains have to connect with the sewers in the roadway in front of the house, the sanitary arrangements should be so ordered that the drain runs along the passageway or hall, from back to front, and not crosswise or under any of the rooms. The reason for this will at once be obvious, as, should a bursting at any time unfortunately happen, the drains can be got at and the damage rectified without much disorder. All the sockets of drain-pipes should be hermetically joined, in order that no foul gases may escape into the house, and with this object only the very best cements should be employed on this, the most important part of the work.

An important matter to be borne in mind by the builder is that all sinks and gully-holes must be trapped, in order that the foul gases evolved from the putrid substances in the pipes should not be permitted to escape into the air outside or inside the building: as there are a variety of more or less efficient traps in the market, we must leave the choice of them to the builder, impressing upon him the necessity for their use, their perfect fitting and their simple construction. The majority of them depend for their action upon what is known as a water-seal, but there are many beside these somewhat old-fashioned but decidedly efficacious traps.

In laying down sewers, curves should be avoided, and that for two reasons: matters may become lodged in corners or bends, thus causing a stoppage and possible bursting of the pipes; and secondly, on account of bad jointing-up of the sockets by careless workmen, which would allow the matters to escape, to the certain damage of the surroundings. The fall should be direct and gradual, without any level stretches in it, to allow of a continuous and free passage of the sewage matter; the pipes, be they iron or glazed earthenware — the latter for preference — should be used in all cases where possible, in lieu of a brick-built sewer; and, lastly, care should be exercised that no faulty or cracked pipes are put down, while the best workmanship should always be put into drainage work, so far as it applies to the sewering of cities and houses.

All drains should be so laid that they can be easily got at, and so that it shall not, except under very extraordinary circumstances, be necessary to pull up any flooring in the house other than the passageway, or to knock down any portion of the structure. Of course there are times when these contingencies cannot possibly be avoided, but if all drains are run beneath the passages or hall-ways of houses, and laid at right-angles, the minimum of inconvenience, should it be necessary at any period to open them, will have been attained; while a little attention and care, when planning the drainage of a new district, combined with a study of the architect's plans, which are generally available, will enable the work to be done properly and finally, instead of being pitchforked down anywhere and anyhow, as is too often the case with careless and ignorant workmen, who imagine that when they have laid the pipes down a certain distance in the soil, they have done all that is necessary. Finally, all rain, closet and bath pipes must be so trapped that the water easily runs down, but that the bad air will not come up, and it is a good plan to run such pipes to the tops of the buildings. But I shall have somewhat to say of this later. If our young workmen will only pay attention to the succeeding wrinkles, they will have no cause to regret it in the course of their working lives.

W. N. Brown.

[To be continued.]

SOCIETIES

BOSTON SOCIETY OF ARCHITECTS. — GENERAL REGULATIONS OF THE ROTCH TRAVELLING SCHOLARSHIP FOR EXAMINATION, 1887.

THE Rotch Travelling Scholarship was founded by the children of the late Benjamin S. Rotch, in pursuance of their father's intention of founding such a scholarship during his lifetime. The direction of these examinations for this scholarship has been intrusted, by the Trustees of this Scholarship, to the Boston Society of Architects, under certain conditions. The committee holds the examinations yearly.

The successful candidate in each yearly examination will receive from the trustees of this Scholarship annually, for two years, $1,000, to be expended in foreign travel and study; provided always, that the beneficiary shows such fitness and diligence as may be required of him.

Candidates must be under thirty years of age, and must have worked during two years with an architect resident in Massachusetts. The committee of the Boston Society of Architects having in charge the examination for the Scholarship invite candidates to be present at the Boston Museum of Fine Arts on April 7, 1887, at 9 A. M. A problem in design will be given to all candidates, and they will be required to make a preliminary sketch for it at the time. The authors of satisfactory sketches will be allowed one month for their development — all the essential features of the scheme being retained — into finished geometric drawings, rendered in color with projected shades. An accurate perspective of the finished elevations must be drawn in line. The set of drawings must be accompanied by a thesis explaining the principles of architecture, historical and æsthetic, which governed the choice and development of the design. Authors of the selected preliminary sketches will be required to pass examinations on the following subjects:

First. History of Architecture and of Arts immediately connected with it.
Second. An elementary knowledge of the French language.
Third. Perspective and projection of shades and shadows.
Fourth. Construction, theory and practice.
Fifth. Free-hand drawing from the cast. A six-hours' study will be required.

The committee make the following suggestions for the help of students preparing themselves for examination. In studying the History of Art, that they should read Lübke's "*History of Art*," Fergusson and Rosengarten's works on Architecture; in the French language, to exercise themselves in reading at sight portions of Viollet-le-Duc's writings; in perspective, the treatises of Professors Ware and S. E. Warren, and Ruskin's "*Elements of Perspective*."

In construction, familiarity with ordinary practical construction in wood, iron, and masonry, and computation of the strength of materials, are expected of the students.

"*Notes of Building Construction*," of the South Kensington series; Green's "*Graphics*"; and Clark's "*Building Superintendence*," — are recommended by the committee.

In a total of 175, architectural design will count for 100; construction and perspective, 30; architectural history, 20; free-hand drawing, 15; French, 10.

N. B. Examinations in subjects other than design will be held on April 11, 12, and 13.

TRADE SURVEYS

Something akin to a real-estate boom is in progress throughout the Southwest and West; it may, and quite probably will sweep eastward within twelve months, causing a general advance in the value of land, in manufacturing centres especially. This is a very broad, and perhaps a dangerous statement to make, but the indications are certainly very strong in favor of such a probability. It is only necessary to look at the progress of industrial enterprises in the South, especially Northern Alabama and certain sections of Tennessee and Georgia. The improvement set in in the coal and iron making districts of Alabama, and extended to surrounding localities; it moved northward, striking Nashville and Louisville, and has shown itself in a very pronounced way in Kansas and Missouri, and even in Nebraska and Iowa. Reliable authorities in several Western cities speak of the improvement as a "boom," and furnish interesting details as to the advance of land in certain localities where manufacturing and trade-requirements are of a very urgent character. It is unnecessary in a survey of this kind to endeavor to diagnose the causes and surrounding conditions of such an improvement — but simply to record the fact and note, in a general way, its present and probable future course. The abundance of money is one of the strong causes leading to this activity. The necessities for more extended travelling facilities, for larger supplies of iron and steel, and more house, factory, and mill accommodations are behind this force. The American people are moving on to a higher plane, where heavier requirements will be a permanent factor, and where a larger earning and consuming power will be maintained. Authorities in Minneapolis, St. Paul, Chicago, Detroit, and even in smaller cities, as Cleveland, Pittsburgh and Wheeling, speak with confidence of a *bona fide* improvement in real estate in and around those cities. Manufacturing enterprises are springing up among them and extending into the smaller towns. Real-estate operators are actively engaged in negotiations in the cities and towns, large and small, throughout the West. The East is sharing in the improvement, although it is more moderate, and of a more legitimate and enduring character. In Philadelphia a steady expansion in the values of property in and near the city is spoken of. In New York an improvement, apparently somewhat speculative in its character, is manifesting itself, but, after all, it is a legitimate advance. Along the Atlantic coast we discover evidences of activity and improvement, based upon legitimate causes.

The supply of building material will equal all requirements. A large amount of business remains untransacted, because of the uncertainty as to freight rates. During the past thirty days — in fact, ever since the new Inter-State Commerce Law was signed — the lumber-dealers have been crowding shipments East, West, and South, and secondary markets throughout the country are now pretty liberally supplied. The distribution of lumber from wholesale yards has increased within the past few days. The rush of lumber from Chicago to the East is spoken of as being "like a current of a mighty river cutting a deep channel through contiguous territory, leaving the space on either side high and dry." This movement has been caused by the low freight rates; it will terminate April 1. Eastern buyers have purchased very heavily of white pine, and are now engaged in placing contracts for lumber supplies from the South. Rolling-stock is taxed to its utmost capacity at all lumber centres, and the local demand in all towns is reported to be steadily increasing. In Minneapolis, 72 permits were issued last week; in St. Paul, 90; in Philadelphia, 140; in Pittsburgh, 60; in several other towns from which reports are received, the number ranges all the way from 20 to 100 for the week. These facts show that builders will be fully employed, and that building-material will be in active demand. The great industrial barometer, the iron trade, points to a general improvement in demand in April. During the past three weeks business has been checked by several causes, such as the heavy purchases made during the two first months of the year, the uncertainty during the past month as to freight rates in the future, and besides this, the high range of prices reached, warned customers not to place heavy contracts for future delivery, in view of the possibility of heavy foreign importations.

All the furnaces and mills are crowded with orders, and capacity, in nearly every direction, remains unsold. The steel rail-makers have approached within 300,000 tons of their gross capacity. There are inquirers on the market for very large lots of foreign rails, as well as other foreign material. Within the past week large orders have been placed for locomotives, and larger orders for cars. The structural mills are considering inquiries for supplies for bridge-building, and will, no doubt, have their capacity fully occupied throughout the East. Nails are quoted at $2.50, car-lots in the East, and $2.70 West. Bar-iron, $2.20 East, $2.10 West. Plate-iron, $2.40; steel-rails, $39 at mill; old rails, $23 at tidewater; steel-blooms, $32 to $35.

The demand for wood-working machinery continues steady, especially in the West, and some establishments have three months' contracts for their regular force. East of the mountains shops are not crowded with orders, but are doing a fair business. Sash, door, and blind factories East and West are full of business.

The supply of slate, stone of all kinds, and brick of all qualities, will be fully equal to current requirements, and there will be no delay in meeting demand this year, as there was last. The labor question has been disposed of, and manufacturers have been busy since last summer in arranging to meet the demand which they were wise enough to foresee.

The anthracite coal combination will mine 34,000,000 tons this year, of which the April out-put will be 2,250,000. The combination has been virtually renewed, but in such intangible shape as to be beyond the reach of legal technicalities. The bituminous coal pool has been formed, though no direct effort will be made to control the price of coal in markets, but only at distributing points along the Atlantic Coast. The bituminous coal production will be from 10 to 15 per cent heavier this year than last, while the anthracite will be little, if any heavier. Western coal producers will mine and ship about 10 per cent more than last year, and at prices ranging from 5 to 10 per cent higher. Fortunately for the country at large, the labor organizations have wisely decided upon pursuing a conservative and law-abiding course; the baser elements of organized labor have been placed under discipline, and the organizations, both of the Knights, and of the old Trades-unionists are bent upon making the best of the exceptional opportunities afforded for employment at good wages. Legislation is being earnestly sought for in several States, and the law-makers are showing a creditable desire to meet all reasonable requests upon the part of the wage-earners.

The American Architect and Building News

ADVERTISERS' TRADE SUPPLEMENT.

No. 58. SATURDAY, APRIL 2, 1887. VOLUME XXI. No. 588.

STAINED-GLASS.

DURING the past ten years or so, the art has developed in a surprising manner, until now the material is employed in every variety of building with excellent results. Much of the good effect in stained-glass will depend upon the artistic merit of the design, and, unfortunately, with the greatly-increased use of the material, much of it has been manufactured of a very inferior and inartistic order.

At the same time, it is but fair to say that development of the art has been productive of work from some of our best artists, which has reached a standard of merit comparing favorably with, if, indeed, it does not surpass that of past ages, as exemplified in the magnificent examples still found in the European churches, many of them in as good a condition as on the day they were executed.

Foremost among the artists whose efforts in this direction have been so successful, says the *Scientific American*, is Mr. Louis C. Tiffany, now the President and Art Director of the Tiffany Glass Company, of 333 Fourth Avenue, New York City. This company have executed the designs of some of our leading artists, among whom may be mentioned Maitland Armstrong, Robert Blum, E. W. Longfellow, F. D. Millet, Elihu Vedder, and W. H. Low. Its work is represented by memorial windows and less important work in all parts of the country, and among these may be mentioned that in St. Paul's, Milwaukee, Wis., which is a reproduction of Doré's renowned painting, "Christ before the Prætorium." This window contains nearly two hundred life-size figures, and is all executed in colored glass alone, the only portions painted being the faces, hands and feet. The innumerable shades and forms, the folds of drapery, and the numberless shadows are obtained by the use of colored glass of different tones, and the whole work is of rare merit.

The Company have executed work in many of the public buildings in this country, such as Columbia, Yale, Princeton and Williams Colleges; the White-House at Washington; the Cotton Exchange, the Seventh Regiment Armory in New York, and in a very large number of private residences and smaller buildings.

A BIG ROOFING CONTRACT.

THE contract for supplying the tin for roofing the Grand Union Station at Indianapolis has just been awarded to Messrs. N. & G. Taylor Co., the well-known tin-plate and metal importers, of Philadelphia. It is of so large a magnitude that it forms the topic of general conversation among the trade. Fifteen prominent railroads will centre in the immense structure, the total cost of which will exceed $1,000,000. The depot proper and baggage rooms will be 150 feet square, and the train-sheds adjoining the depot some 750 feet long by 190 feet wide. The building will be composed principally of glass, iron and dressed stone of artistic shape and design.

The plans were designed under the supervision of Mr. Thomas Rodd, engineer and architect for the Indianapolis Union Railroad Company, at Pittsburg.

The tinwork on the buildings will be done by Mr. Thomas W. Irwin, of Allegheny, Pa., and Messrs. Carpenter, Annear & Co., of Louisville, Ky.

The award to Messrs. N. & G. Taylor Co. is for their "Old Style" brand of roofing. It is claimed to be the best roofing-tin in the market to-day. Every sheet is made by the old manner of hand-dipping, as first made in Philadelphia in 1830, and sold by this firm. It is thus called the "Old Style" double-coated and redipped. It is said to outlast any other roofing made.

Messrs. N. & G. Taylor Co. are one of the oldest firms in the United States, having been established in 1810. Their reputation for integrity and enterprise is well known.

They state that to fulfil their present contract it will take some 500 boxes of the 28 by 20 inch size ternes, there being in all some 150,000 square feet of surface. This is the largest contract ever awarded for so fine a grade of roofing-plates, and it is a significant fact that in this age of deceptions, cheap qualities and imitations, especially in roofing-tin, so decided a preference should be expressed from so high a source in favor of this firm's brand over all competitors.

This same brand of roofing was selected by the Board of Guardians of the Poor, to cover the Blockley Almshouse, in West Philadelphia, some months ago. Some 200 boxes were used there. Wherever the tin has been brought to the notice of practical men, unbiased by any political favoritism or otherwise, it has met with favor, and many instances could be mentioned in every prominent city and town in the country where this fine brand has been chosen over all others on account of its superior quality.— *Philadelphia Press.*

NOTES.

THE Gurney Hot Water Heater Company of Boston, Mass., have just published a work entitled, "How to Erect a Hot-Water Apparatus" for the information of plumbers and steam-fitters and those who desire more knowledge respecting this system, and will be pleased to furnish a copy, upon application to their address, 237 Franklin Street, Boston, John A. Fish, managing director.

The book is very neatly printed and illustrated, and very valuable to fitters.

SALES of boilers made recently by the Babcock & Wilcox Company are as follows: F. Probst & Company, N. Y. City (for export), fifth order, 82 horse-power; Wise Brothers, Baltimore, Md., 102 h.p.; J. and R. Meily, iron-masters, Lebanon, Pa., 208 h.p.; Lickdale Iron Company, Lickdale, Pa., 450 h.p.; Forest City Sugar Refining Company, Portland, Me., second order, 140 h.p.; Columbia Rolling Mills Company, Watts, Pa., 136 h.p.; Mahoning Rolling Mills Company, Danville, Pa., second order, 125 h.p.; Arlington Mills, Lawrence, Mass., 2880 h.p.; Gordon, Strobel & Laureau, L't'd., Philadelphia, Pa., third order, 45 h.p.; The Alabama & Tennessee Coal and Iron Company, 1872 h.p.; Judson Manufacturing Company, San Francisco, Cal., second order, 292 h.p.; total, 6332 h.p.

THE American Fire-Insurance Company of Philadelphia makes a very handsome showing for the year 1886. It increased its assets $383,426.61, which now stand at $2,301,858.66. During the twelve months it increased its net surplus from $447,821.13 to $552,874.22. The American is one of the most-progressive fire-insurance companies of Philadelphia, and at the same time one of the most conservative. Its president, Thomas H. Montgomery, is one of the best-known and most-experienced fire-underwriters of this country, having been the general agent of the National Board of Fire Underwriters. Its latest move in the line of progress is the establishment of a department in Great Britain, under the management of Mr. J. Hugh Middleton. Its London office for this department will be at 16 Cornhill.

THE Wainwright Manufacturing Company, 65 and 67 Oliver Street, Boston, Mass., note sales of their Corrugated-Tube Feed-Water Heaters during the month of March as follows: two in Boston, one each in Revere, Melrose, Hyde Park, and Warren, Mass., Keene, N. H., Plainville, Ct., Chester, Pa., Chicago, Brooklyn, and four to New York.

They further write that they have recently received their second order from Japan for one of their heaters, to be used in the extensive Edison plant soon to be installed there.

DECISION IN FAVOR OF WHEELER WOOD FILLER.

IN the United States Circuit Court for the first circuit, at Boston, Colt, J., a final decree

for an infringement and accounting was entered on the third Monday of February last, in the suit of the Bridgeport Wood Finishing Company *vs.* Asahel Wheeler, in equity. This decree affirms the validity of the Wheeler patent, and restrains infringement thereof by the use of ground silex in wood fillers.

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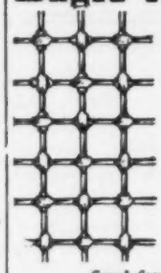

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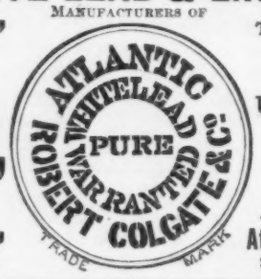

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These Pulps are made in three colors, — *red*, *brown*, and *black*, — all of about the same strength, and each one working as well with the mortar as the others.

Each Pulp contains materials that strengthen the mortar.

None of them increase the *white deposit* on the surface of the brick.

No special *directions for use* are necessary. To get the coloring even, care should be taken that the mortar is well mixed and free from lumps before the color is hoed in.

It is a good plan to keep the Pulp covered with water after a package has been opened, to prevent crying.

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The amount will, of course, vary slightly with the thickness of the joint and the depth of shade required; but, for average work, thirty-five pounds are enough.

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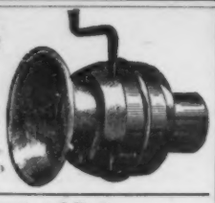

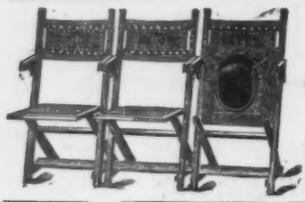

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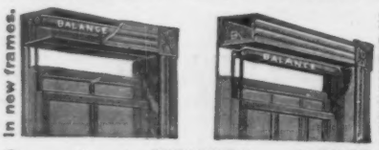

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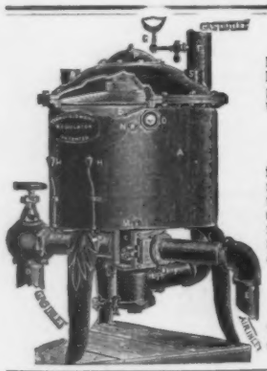

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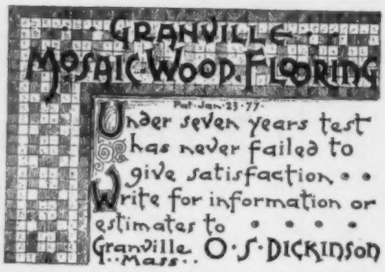
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